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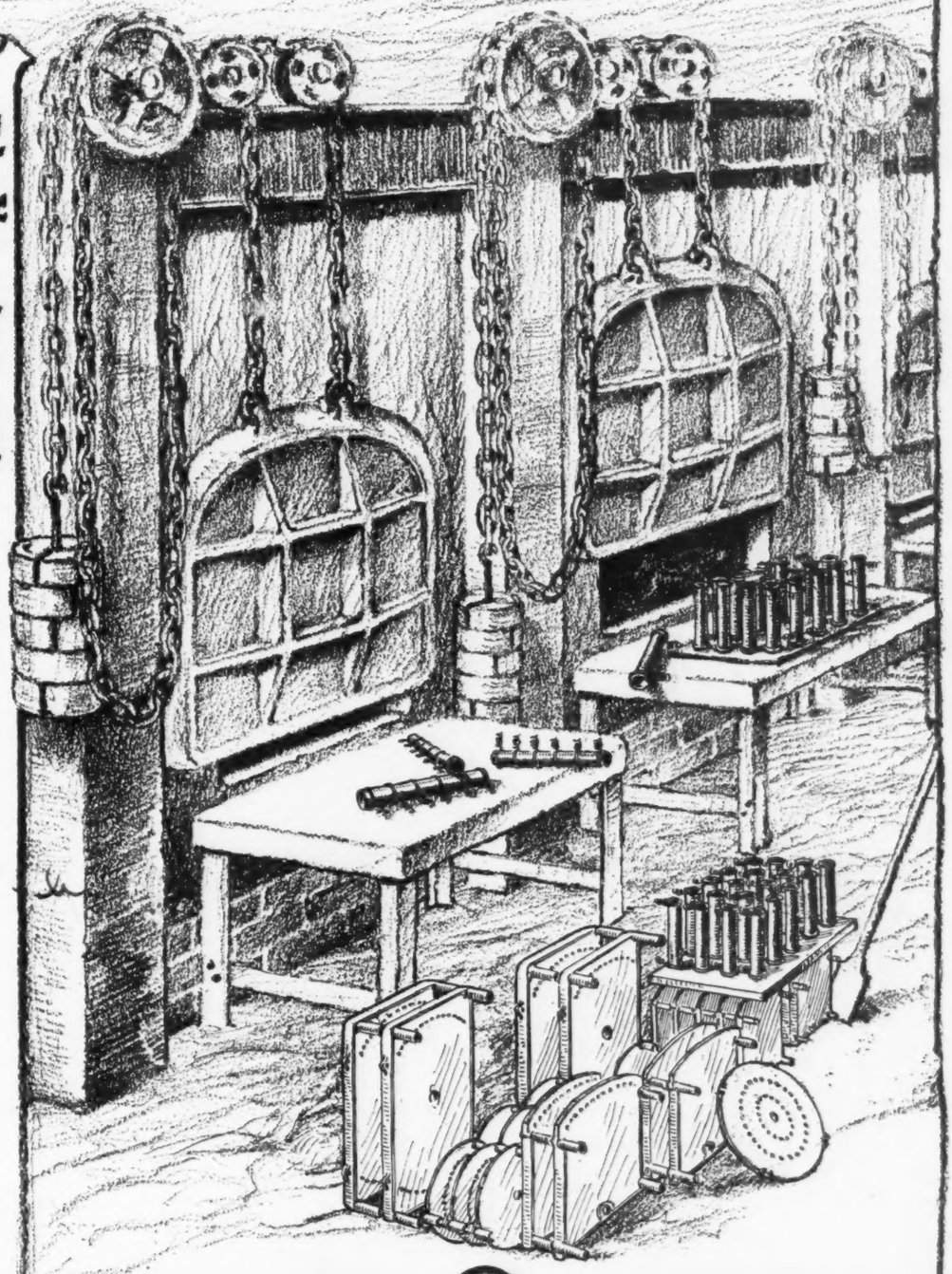

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Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

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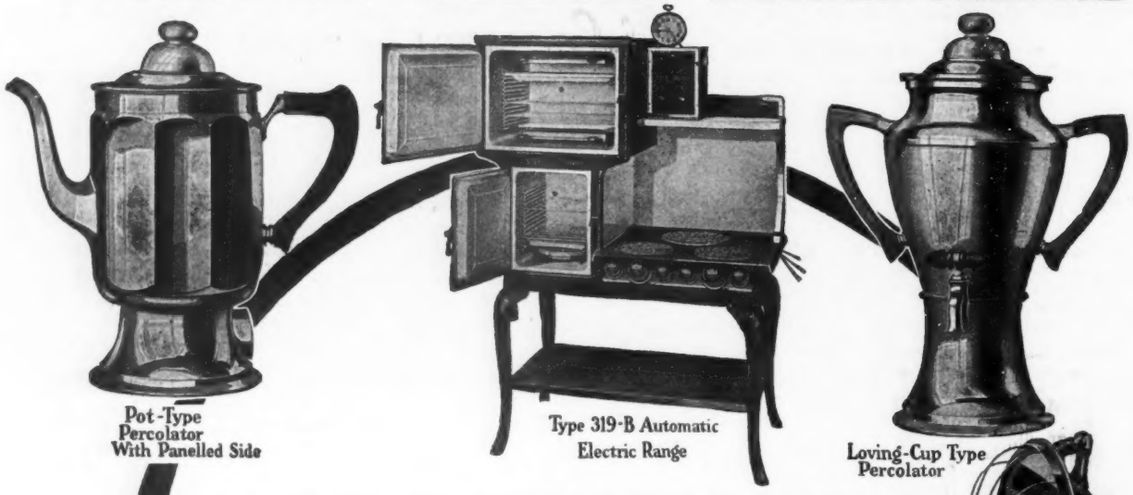

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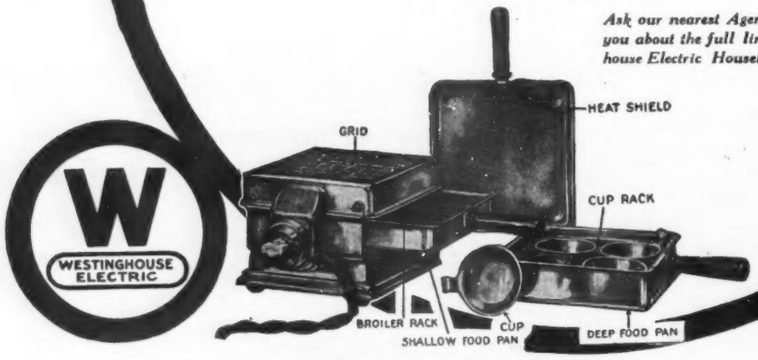

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, November 2, 1918 *Number* 18

The Low Cost of Lighting

IT IS a very small part of his cost of living that the householder pays to the electric utility for lighting his home. A report of the National Industrial Conference Board on "War-Time Changes in the Cost of Living" states that from 4 to 6 per cent of the expenditure of the average American wage earner's family is for fuel and light. The bulk of this is, of course, for fuel for heating or cooking, and only a little of it goes for electric lighting. Under conditions in most communities, where the average wage earner would use electricity either for lighting alone or for lighting and simple incidental household uses, the total annual electric bill would be almost lost to sight in comparison with the other items which make up the old bugbear, high cost of living. Even when the toaster and grill, the iron, the curling-iron heater, the vacuum cleaner and the washer are used by milady, the expense is an unimportant feature in the budget. It is the cost of heating the home, cooking meals and washing that is responsible for most of what we find frequently expressed in the statistical compilations as expense for "fuel and light"; and it is therefore confusing, if not misleading, to bring "light" into the compilations in the way that has been done.

In the main the electric utilities have made the increases in rates resulting from higher war costs so that the burden falls upon the large users of energy for power purposes and have refrained from asking the householders to share in it. This practice has not been universal, however, and from the standpoint of equity there is no reason why, if basic rates are fair as between the different classes of users, an increase in the cost of supplying all should not be shared by all. For reasons of policy many of the companies have wisely thought it best to continue domestic rates without advance, thus ignoring the additional cost fairly allottable to the consumers of this class. Naturally, the very small plants having little or no power load cannot do otherwise than raise rates to all if they are to try to offset the heavier operating charges.

Electric central stations may invite with confidence a full investigation into their aloofness from all participation in the unjustified high-cost-of-living visitation which has been inflicted upon the public. They have not got out of their customers as much increase as the increased cost of doing business. They are like the railways in suffering a heavy addition in all costs, but, unlike the railways, they have no single courageous government hand to make an arbitrary increase in all classes of their rates. They have had to prove their case for more adequate rates before the public service commissions and before their communities and individual consumers. They have proved it. They are entitled to credit as efficient public servants for having continued to do business steadily under most trying conditions of operation without taking the unfair advantage which we have seen taken in many industries by predatory corporations and predatory individuals alike. They are not profiteers; they have not lost the discriminating sense of being quasi-public, of holding a position of trust.

Another Phase of Interconnection

WE HAVE repeatedly noted the good effects of interconnection in the case of large hydroelectric systems. Its advantages are so obvious that they would hardly here call for comment were it not for the divers conditions accompanying particular cases and sometimes throwing new light on the economies of the situation. Such an instance is described by R. H. Halpenny in the current issue. The peculiarity of the interconnection with which he deals is that it does not involve the matter of auxiliary steam plants commonly enough found, nor yet the possibility of gain from uniting plants on different watersheds. It is a case confined to economy of water gained through diversity of load. The plants involved are those of the Nevada-California Power Company and the Southern Sierras Power Company, five in number and all situated on the same stream only a few miles apart.

The distribution systems of the two companies, however, are widely different. That of the first-named company is devoted to the service of the southern Nevada mining country. It has about 270 miles (435 km.) of line all told, on wooden poles and operated at 55,000 volts, "Y"-connected with grounded neutral. The second company has a double-circuit steel-tower line 239 miles (385 km.) long and reaching the southern California country around San Bernardino, which represents entirely different load characteristics. The load, too, has grown so rapidly that in spite of hydroelectric power steam reserve is necessary at the peak, which comes at an hour differing materially from the peak on the Nevada load. The situation was met by installing a control station for interchange of power to the extent of 6000 kw. The southern California line is intended to work at 87,000 volts delta or 140,000 volts "Y," although temporarily operated at 55,000.

Experience shows it to be undesirable to connect

the lines directly, one being "Y" and the other delta, and the higher voltages for the longer line require transformation in any event. An outdoor transforming plant was therefore installed and has proved its usefulness. It enables the water in this single stream to be worked at best advantage, the necessary plants which supply the load being kept in operation either working directly on their own systems or interconnected so that each may supply the needs of the other. It is an admirable example of the advantages of interconnection as related to the simple issue of varying load conditions on the two systems involved.

American Colleges and the Nation

IT IS a trite remark that a great war cannot be won without fighting. To fight in a great war means to produce and maintain great armies. About four per cent of the soldiers must be officers—that is to say, men who have to assume responsibility—so that an army of a million men needs about forty thousand officers. These officers have to possess not only a considerable amount of general civilian knowledge but also a large amount of technical military knowledge. The amount of necessary technical military and naval knowledge, including all arms of the service—infantry, cavalry, artillery, aviation, staff, ships, drill tactics, strategy, roads, railroads, signaling, communication, supplies, gas, medicine, surgery, law, etc.—is so great that no officer can possibly know more than a small part of it, and each officer has to be, in some sort, a technically trained specialist.

Officers are produced either by promotion from the ranks or by selection and training from civil life. Some of the best officers in the army are raised from the rank and file of the men, but in practice the supply of officers through this avenue is too limited. The bulk of the supply has to come from the colleges, which provide the special preparatory training that is needed in languages, history, mathematics, chemistry, physics and military sciences.

In order to provide an adequate supply of officers for the American army on the present scale of production the government has virtually commandeered the colleges all over the country, so that youths from the high schools may be inducted into the army as privates, entering college on regular pay and subsistence. They become enrolled in the Students' Auxiliary Training Corps and live in college a military life. They sleep in barracks, are bugled to meals and studies and march to regular drill. Their studies are assigned to them at regular intervals, for eight hours a day. This process continues for twelve months in the year. After a certain period those who carry on their training successfully are likely to receive promotion to commissions as junior officers, while those who fail to keep up drop out into other grades.

This militarization of the colleges means for most of them a great change in their habits and modes of thought. The technical colleges undergo the least change, because a relatively small revision of their schedules enables them to prepare their students for the various branches of military engineering. The change is greatest in the classical colleges, where the regular curriculum is necessarily much altered to meet military needs. There is no doubt, however, that the plan of college militarization is adapted to meet the urgent military necessities of the nation.

Some persons believe that the plan of the governmental control of the colleges, now in operation, is destined to survive the war and that the colleges will never return to their original status after the destruction of the Teutonic domination by force and the return to long-sought-for peace. In one sense, at least, this is likely to be true; namely, that the influence of the war training on the colleges is likely to persist and have recognizable effects long after the war is over. We do not believe, however, that the present system will be continued perennially into peace times. The whole world's history will have been so profoundly changed by the war that it is very difficult to foresee clearly what will follow in any country. It is unsafe to prophesy or to dogmatize. It would, however, be very unfortunate to maintain war standards either in education or in manufacture during times of peace. During war time all fine arts and beautiful but unessential things must go into neglect. In the untroubled times of peace, however, any person should be permitted to study at college any subject which he desires to master. A machine-made college course, administered governmentally to all students alike, would be a sad aftermath of war, for the government, the people and the world at large.

Power-Factor Correction

WE PUBLISH this week an article by Will Brown supplementing his former comment with a little closer study of the difficulties and remedies of the power-factor situation. He cites several striking instances of loads extremely bad as regards power factor. They are usually due to underloaded motors, especially in the case where individual drive is carried to such an extreme that many small motors are in operation all normally somewhat underloaded. In such cases the power factor may drop to an astounding extent, in one instance to 35 per cent, and accompanied by a 35 per cent load factor at that. The result is overloading of the generators and of the transformers, to say nothing of occasional trouble on the line. The difficulties at the present moment are enhanced by the trouble in getting a supply of motors of the right sizes, so that their rated output can be properly adjusted to the requirements of the load. Remedial measures consist in the main of using synchronous machines whenever possible with the excitation set to relieve the general power factor and in readjusting so far as possible the load upon motors which prove to be of improper size for their work.

It is not a difficult matter to test general and local power factors so as to find the seat of the trouble in any particular distribution system. Sometimes the evil conditions can be directly traced to a particular point at which they are easily remedied; at other times the difficulty seems to be widespread and demands a good deal of care in investigating local conditions in order to obtain data for remedying the trouble.

Considering the extent to which this particular mis-

chief has grown, there is certainly justification for punitive measures on the part of the supply companies. These companies should, however, take every precaution to avoid bad installations and by friendly coöperation to detect and remedy the bad conditions already existing.

Certainly a plant which is called upon to supply 200 kva. where only 100 kw. is necessary has justifiable cause for complaint, especially nowadays when the limit of capacity is constantly confronting the companies. Whether it will actually be necessary to sell electrical energy for induction motors on a kva. basis may perhaps be open to question, but some general remedial scheme for poor power-factor conditions is assuredly badly needed.

Operation of Joint Pole Lines

IN CASES where distribution lines have to be erected along public ways there is often raised, and with reason, an objection to the duplication of pole lines. These are frequently unsightly and also in many instances unnecessary, and there has been a steady tendency toward joint operation wherever possible. A brief paper by T. N. Bradshaw gives some account of the regulations tending to this end which are now enforced in the State of Connecticut. Pressure has been brought to bear on operating companies of all sorts to utilize joint lines under careful regulation wherever it is practicable, and there are some 1700 miles (2750 km.) of such line now operating in the state referred to. The wires accommodated are those of the electric light and railway companies and telephone and telegraph lines. The main features which have to be looked after in the interests of safety are sufficient vertical clearance space between the several systems and climbing room on one side or the other of the pole line to provide opportunity for making safe and convenient repairs.

A minimum of 40 inches (102 cm.) has been taken as standard clearance in the Connecticut practice; the occupants, however, often prefer to have more. Thirty inches (75 cm.) is required for adequate climbing space. The light and power wires are so far as is possible kept on opposite sides of the poles, and their vertical runs to services keep to their own side. Circuits fairly to be classified as high-tension are better run on separate rights-of-way, and this is generally done. The Public Utilities Commission of Connecticut has promulgated a set of rules and specifications dealing with the matter which seem to have produced very satisfactory results. The gains by joint usage are material both to the community and to the operating companies. The former escapes unnecessary duplication of poles, and the latter frequently finds that by thus owning a portion of a complete system the construction costs are materially lower.

Mr. Bradshaw points out in his article an important additional advantage in that the lines thus constituted are in general of rather sturdier construction than usual and hold up better under storms. Furthermore, they are likely to get more frequent inspection and better maintenance.

The Increasing Use of Induction Generators

ANOTHER instance of the admirable engineering in the hydroelectric plants on the Pacific Coast is furnished in the little article by L. J. Moore describing the gain of additional power by special automatic generating stations worked from induction generators. These plants are on the system of the San Joaquin Light & Power Corporation, which was pressed for additional output. The main plants of the company are fed from a storage reservoir secured by a dam 125 feet (38 m.) high. There is at times available at this dam nearly its full head, while when the reservoir is nearly empty the head for the most part disappears. This head due to the dam had not been utilized, the reservoir simply being tapped to supply water for the intake of the conduit lines proper. Now the water thus drawn is to be passed through the wheel of the auxiliary plant supplied with a 1000-kw. induction generator, which is used so far as the head permits, thus saving energy which would otherwise inevitably go to waste.

A second plant of a very similar character and somewhat less than half the capacity has been installed 12 miles (19 km.) down the line to pick up a hitherto unused 45-foot (14-m.) fall. Both plants are operated without governors, using all the water available and working without attendance. There is automatic motor control of the turbine gates determined by the water level in the intake, and provision is made for shutting down the unit in case the plant should be disconnected from the main system. The induction generator lends itself particularly well to this sort of usage on account of the simplicity of its switching arrangements and the ease with which its operation becomes practically automatic. There are many cases in which falls of comparatively modest character can be utilized effectively in this way as an auxiliary to the power house which is charged with the main burden of the transmission work.

The Coming Issues

INASMUCH as curtailment of lighting is a subject that has been before the public frequently since the war began, and because it involves a movement which may be injudiciously carried out unless some guidance is given, some very valuable suggestions by the Illuminating Engineering Society committee on war service will be published shortly. A third installment of Will Brown's articles on how to improve power factor will also be presented. From the Pacific Coast an article has been received relating how one of the hydroelectric companies has rehabilitated its water conduits, water turbines, etc., so as to utilize water power more economically. M. M. Samuels and F. Bechoff, joint authors of articles that have appeared in the ELECTRICAL WORLD on safety features in switching installations, will discuss another phase of this subject in an early issue.

Economy of Water Effected by Interconnection

Two Hydroelectric Companies, Operating Plants on Same Stream, Are Interconnected Through a 6000-Kva. Transformer—Difference in Load Characteristics Permits Increasing Total Load with Same Flow of Water

BY R. H. HALPENNY
Electrical Engineer, Southern Sierras Power Company

AT THIS time, when every effort of a nation at war is being made to conserve fuel, it is a patriotic duty as well as a business necessity for every electric power company to give special study to the finding of possible economies. In order that the greatest amount of conservation be possible, it is essential that companies operating in the same or adjacent territory make a study of load conditions peculiar to each with a view toward determining what possible economical advantage is to be had by an interconnection of the systems. There are valleys in the daily load curve of the Nevada-California Power Company that allow the plants operating on that system to deliver 6000 kva. to the Southern Sierras Power Company system through the three-phase tie-in transformer, and to do this without the use of any greater quantity of water than that required by the Southern Sierras plants operating on the same stream.

When two or more companies make use of both hydroelectric and steam-electric generating plants it is often possible to profit by the dissimilarity in the load curves of each company to effect a saving in fuel by the more advantageous use of available excess hydro power resulting from an interconnection of the systems. By such interconnections of their systems various groups of power companies in this country have made possible the use of great quantities of coal and fuel oil for other purposes. A typical interconnected group is that of southern California. The magnitude of the resultant fuel conservation and the extensive character of the interconnection have been presented to the readers of the ELECTRICAL WORLD in the interesting article of R. J. C. Wood in the issue of Aug. 24, 1918.

It is not the intention in this article to deal with the subject of fuel conservation as accomplished by the tying together of a number of large systems. It is proposed instead to describe an interconnection of two electrical systems that makes possible the greatest economy in the use of the same storage water by certain of the generating plants of both systems.

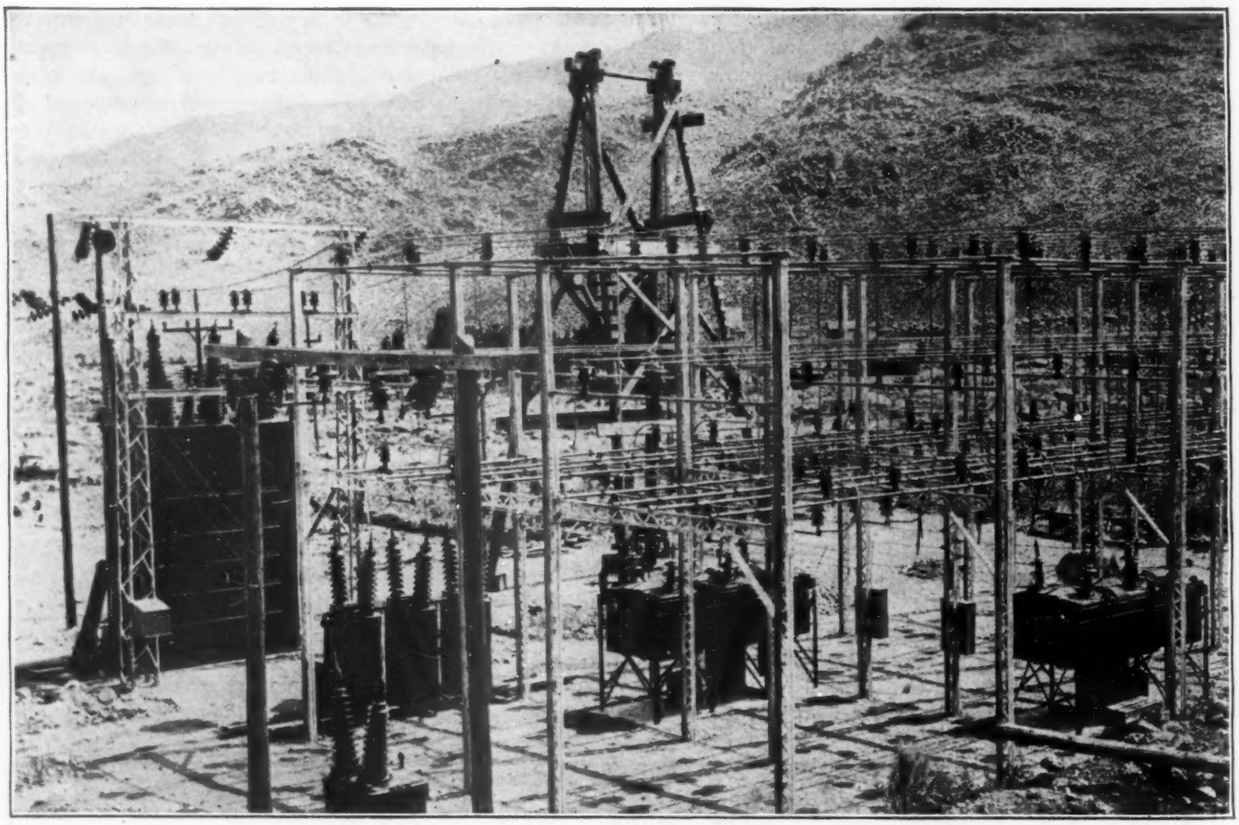


FIG. 1—IRON-PIPE BUS STRUCTURE OF CONTROL STATION AT JUNCTION OF INTERCONNECTED LINES

On a small stream on the eastern slope of the Sierra Nevada mountains the Nevada-California Power Company developed storage facilities and installed three hydroelectric plants during the period 1905 to 1908.

Typical of many streams in the Sierra Nevada range this one, known as Bishop Creek, is served by a watershed of considerable area and has a rapid fall, dropping more than a mile (1.6 km.) in 14 miles (22 km.) of length. The area comprising the watershed is about 39 sq. miles (10,000 hectares) in extent and is made up of three separate run-off areas from which issue the

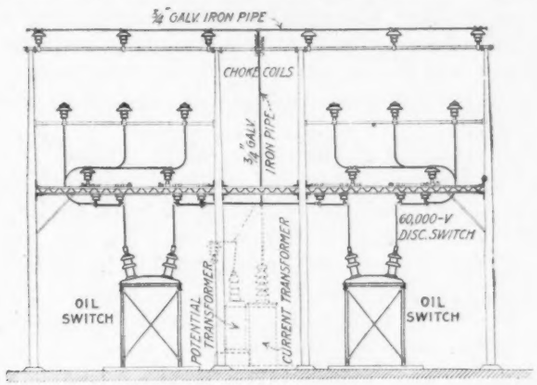


FIG. 2—CROSS SECTION OF OUTDOOR SUBSTATION SHOWN IN FIG. 1

North, Middle and South Forks of the creek. Natural storage sites on the south and middle branches of the creek were utilized, and by the construction of dams a total storage capacity of 21,000 acre-feet (25,800,000 cu.m.) was developed.

The natural flow of the stream varies from 20 second-feet (0.6 cu.m. per second) to 700 second-feet (20 cu.m. per second) at different seasons of the year, and it is evident from this that storage is essential for the continuous operation of generating plants; in fact, during four months in the year it is necessary to depend on storage water to a very large extent.

Two transmission lines were built into Nevada for the purpose of serving the mining district in and around Goldfield, Tonopah, Manhattan and other southern Nevada mining towns. This transmission system, with a mileage of 270 miles (430 km.), is of wood-pole construction and is operated at 55,000 volts "Y," with neutral solidly grounded at generating stations and substations.

SYSTEMS INTERCONNECTED

During the years 1912-1913 the Southern Sierras Power Company constructed two plants on Bishop Creek, making a total of five plants on the one stream. The erection of a double-circuit steel-tower line 239 miles (385 km.) in length and terminating to the south of San Bernardino, Cal., made possible the transmission of this additional power to an entirely different section of country from that served by the Nevada-California Power Company, and permitted a more complete utilization of the power development.

The design of the tower line is such that operation at 140,000 volts "Y" is possible, although a transmission voltage of 87,000 volts was decided upon as best suited for the period during which a market for the power was being developed. At the time the line was put into service certain conditions made it desirable to operate it for a time at 55,000 volts, and all transformers were accordingly provided with a 55,000-volt tap. By reason of the capacity in synchronous units available at the southern end of the line it has been possible to operate the line up to the present time at 55,000 volts with reasonably good voltage regulation. This synchronous capacity consists of generating units in the reserve steam plant at San Bernardino and synchronous condenser and frequency-changer sets at the end of some of the more important feeders leaving the San Bernardino station, making in all over 20,000 kva. capacity available for regulating purposes.

Since the Southern Sierras system has been operated at 55,000 volts delta and the Nevada-California system at 55,000 volts "Y," with grounded neutral, it was not considered advisable to operate the two systems as one because of the severe strain that would be imposed on the transformers of the "Y" system by a grounded condition of one of the line conductors, owing to the delta-connected transformers of the plants on the other system. In emergencies it has been necessary to switch one of the "Y"-connected plants to the delta-connected system, but this operating condition has been avoided as much as possible for the reason that a heavy ground on several occasions put one or more of the "Y"-connected transformers out of commission if the latter were operating on the delta system at the time.

It has already been stated that there are five plants on Bishop Creek. These plants are known as Nos. 2, 3, 4, 5 and 6, numbering down-stream. The wheels at No. 2 plant discharge into the intake of No. 3, which plant in turn discharges into the intake of plant No. 4, and in this way the water is not allowed to seek the natural channel or creek bed from the time it enters No. 2 intake until it is discharged from the tailrace of plant No. 6, from which point it is given over to irrigating purposes.

It will be evident from the foregoing that the greatest economy would result from the operation of the five

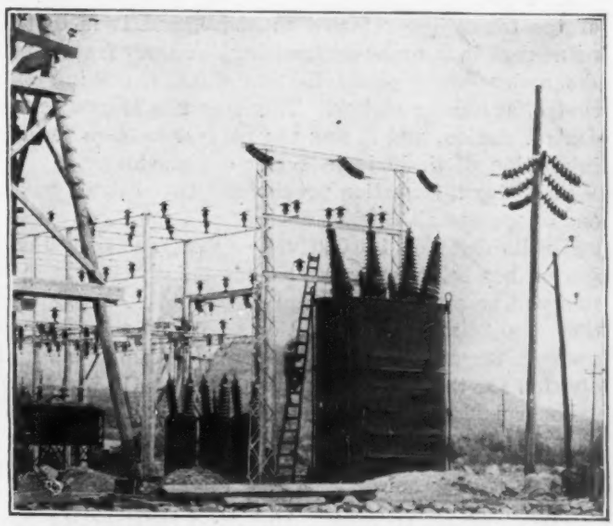


FIG. 3—CONSTRUCTION VIEW OF 6000-KVA. TRANSFORMER. INSTRUMENT TRANSFORMERS AND OIL SWITCHES AT LEFT

plants in such a manner that all the water passing through the wheels of one plant would in turn pass through each of the other plants. This is a condition that it is impossible to maintain with limited forebay capacity and varying loads on the different plants. The load curve of the Nevada-California Power Company systems differs materially from that of the Southern

Sierras Power Company, and as a result the load demands on the individual plants do not occur at the same periods of the day. The load on the latter system has grown so rapidly that in spite of the addition of the recently completed Rush Creek plant with a capacity of 10,000 kw. it is necessary to make use of the steam reserve plant to handle the peak load. This condition makes it particularly desirable to have some means of connecting the plants operating on the two systems so that any excess capacity of the one group could be utilized by the other system, at the same time allowing each plant to

DATA ON BISHOP CREEK PLANTS OF INTERCONNECTED SYSTEMS

	Capacity, Kw.	Elevation, Ft.	Static Head, Ft.	Effective Head, Ft.	Kw. per Sec.-Ft.
Plant No. 2	6,000	7,100	938	850	55
Plant No. 3	6,000	6,280	814	725	45
Plant No. 4	6,000	5,156	1,180	1,000	62
Plant No. 5	1,500	4,728	438	350	22
Plant No. 6	2,000	4,461	280	220	13

operate at a capacity determined by the amount of water passing through Plant No. 2, the plant furthest up stream.

On account of the undesirable condition resulting from a direct tying together of the two systems it was decided to connect the two by means of transformers, this being all the more necessary because of the fact that the voltage of the Southern Sierras system is to be raised to 87,000 volts within a few months. A three-phase, 6000-kva., 87,000-140,000/55,000-volt ("Y") General Electric transformer was recently installed for the purpose of tying the system together, it being the intention to install a second unit of the same capacity in the near future.

Location and Construction of Control Station

At a point near Plant No. 5 is the northern terminal of the tower line referred to above, and it is to this point that it is proposed to bring the lines from all of the hydroelectric plants in that district, making it a control switching station. This center is known as the control station, and it was the natural location for the intallation of tie-in transformer equipment.

Plans for this station provide for two distinct parts, one to operate at 55,000 volts "Y" and the other at 87,000 volts delta or 140,000 volts "Y." The 55,000-volt section has been partly completed, and a brief description will be given. The natural slope of the ground in that locality made it advisable to level off the required area in terraces, and these terraces form a natural division for the two parts of the station. On the upper terrace are the 55,000-volt bus structure and three-phase transformer.

Fig. 1 shows the type of structure and the arrangement of buses, disconnecting switches, meter transformers and oil switches. Unit-type construction has been used, as is the practice of this company in building all of the more important stations. Latticed-steel columns form the upright members of the structure, while 2-in. (5-cm.) iron pipe serves as horizontal supports for the bus insulators and disconnecting switches. Each set of four posts forming one of the structural units is tied together with light fabricated beams, which also carry the pipe supports of the disconnecting switches. The bus is made of 1-in. (2.5-cm.) galvanized-iron pipe with ¾-in. (1.8-cm.) iron pipe risers from disconnecting switches to bus. All of the pipe and steel frame is galvanized.

Fig. 3 shows the partly completed structure and the 6000-kva. transformer. Only a few of the oil switches have been installed. Plans for the completed station provide for two oil switches on each line, so that the lines can be readily transferred to either bus at will. These switches are equipped with remote control; in fact, all of the switches at this station, in both the 55,000-volt and the 87,000-volt sections, will be operated from a 110-volt direct-current bus supplied by storage battery.

The condition of the market at the present time as regards structural steel and electrical construction material has delayed the beginning of work on the new 87,000-volt section of the station. For the present the 87,000-volt lines will be connected to the 87,000-volt single bus of the older portion of the station. A temporary line on wooden poles will serve to connect this bus to the 6000-kva. transformer.

Saving Resulting from Interconnection

The installation of this transformer and the erection of the 55,000-volt section of the station were pushed as rapidly as possible in order to anticipate the seasonal increase of load in August and the months following on the system of the Southern Sierras Power Company. This accounts for the incomplete condition of that part of the station just installed, but does not decrease in any way the gain in available power that the installation has made possible. The water required by the Southern Sierras company is thus used by the Nevada-California company to generate additional energy above its own load requirements, this excess energy being delivered to the former company through the 6000-kva. transformer installed for the purpose. The direct result of this is a saving in fuel oil that would otherwise have to be used in order to make up the power deficit on the Southern Sierras Power Company system. An additional advantage resulting from the interconnection is that both systems have practically acquired 6000 kva. or reserve capacity against the possible temporary loss of a generating unit or plant.

MATERIAL REQUIRED FOR SIX-CIRCUIT STRUCTURE

Seven structural units.
Seventy-two 60,000-volt disconnecting switches.
Twelve three-pole remote-controlled 60,000-volt outdoor-type oil switches.
Eighteen dead-end fittings.
Eighteen ½-in. guy thimbles.
150 pin-type insulators and top clamps (for bus supports).
1400 ft. ¾-in. galvanized-iron pipe (for bus conductor).
550 ft. 1-in. galvanized-iron pipe (for bus conductor).
300 ft. 1¼-in. galvanized-iron pipe (disconnecting switch supports).
1750 ft. 2-in. galvanized-iron pipe (supports).
228 clamp tees.
Thirty clamp crosses.
156 high-tension cast pins.
112 U-bolts.
Sixty pipe caps.

The mileage of the already extensive interconnected system of the southern California companies has also been increased by the addition of the Nevada-California system, which heretofore has had no physical connection with the group. The importance of this additional reserve capacity to all of the companies in

the interconnected group has already been demonstrated. On the occasion of the loss of a large generating unit by one of the companies, the completion of the installation just described made it possible for some 5000 kw. to 6000 kw. to be delivered continuously to the company which was in need of assistance, and in this manner a serious power shortage was averted.

The installation of a large transformer in a locality removed some distance from the railway presented some difficulties in transportation and handling. The core of the 6000-kva. unit weighed something more than 36,000 lb. (16,000 kg.), and in order that this piece could be hauled 15 miles (24 km.) over roads that are in only fair condition it was necessary to make a special rig so that the load could be distributed on two wagons, since no wagon in that district was capable of carrying the entire load.

In order to keep the center of gravity as low as possible the core was slung between two trussed beams. These beams were made up of cedar poles and two sawed timbers that were fortunately available. The wagons were trailers that had been used for tandem haul with tractors, and each had a capacity of 10 tons.

INDUCTION-GENERATOR PLANTS IN CALIFORNIA

Two Hydroelectric Plants Under Construction Will Utilize Water Otherwise Wasted—Plants to Be Automatically Operated

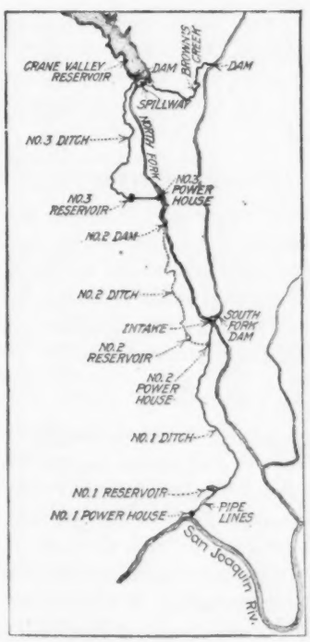
BY L. J. MOORE
San Joaquin Light & Power Corporation

TWO small induction-generator power houses are being erected in the Crane Valley district by the San Joaquin Light & Power Corporation of Fresno, Cal., developing two small heads of water which have hitherto not been utilized. Induction-type generators were chosen in order to make the plants more or less automatic and thus effect a saving in attendance.

The larger of the two plants is installed at the Crane Valley dam and has a capacity of 1000 kw. at an average head of 100 ft. (30 m.). The present Crane Valley chain of power houses is on the North Fork of the San Joaquin River and is fed by the Crane Valley reservoir, having approximately 45,000 acre-ft. (55,000,000 cu.m.) of storage capacity impounded by the Crane Valley dam a short distance from North Fork. This dam is approximately 125 ft. (38 m.) in extreme height. The head available varies from approximately 118 ft. (36 m.) maximum to a very low value when the storage capacity is practically exhausted. No use has been made in the past of this potential energy, the water simply being released from the reservoir through a tunnel under the dam and discharged into the conduit line to the company's power house No. 3. The conception of the plant was due to the necessity during the past year of making some repairs to the outlet gates from the reservoir into this tunnel. It was then decided to go farther than to simply make repairs, and to install a waterwheel and generator to make use of this available head.

The new plant will when placed in operation act as a regulating valve on the discharge tunnel from the reservoir. A steel pipe 48 in. (122 cm.) in diameter has been embedded in concrete in the lower end of the tunnel and will connect with the inlet of the turbine. The amount of water allowed to pass down this conduit will be regulated by the opening of the wicket gates on the turbine, the output of the generator, of course, varying with the amount of water discharged. The plant will operate without governors because it is necessary for the flow in the conduit to the power house below to be maintained at a constant volume according to the orders from the load dispatcher. A 1740-hp. Pelton-Francis turbine directly connected to a 1000-kw. Westinghouse induction-type generator is being installed at this point.

The second plant is situated at the forebay reservoir of the San Joaquin No. 1 power house, about 12 miles (19 km.) below the Crane Valley dam. At this point there was available an unused fall of about 45 ft. (14 m.) in the conduit to the No. 1 power house where it empties into the reservoir. A wood-stave pipe is being constructed to connect the lower end of the conduit with the reservoir, and a turbine designed for a head of 39 ft. (12 m.) is being installed to discharge directly into the reservoir. The unit consists of a 600-hp. end-inlet Pelton-Francis turbine direct-connected to a 425-kva. induction-type Westinghouse generator. The water from the conduit formerly discharged through a pipe and flume into the reservoir, and no use was made of the fall of the water. This pipe and flume will be retained as a by-pass for the water in case of any trouble in the wood-stave pipe or with the unit in the power house. In the installation just mentioned it is necessary to conduct all of the water in the conduit through the turbine so as to generate every kilowatt possible. Therefore, the unit will operate without a governor, but a reversing electric motor will be connected to the wicket gates of the turbine and be operated from a float at the intake to the wood-stave pipe. This float will be arranged to open or close the gates of the turbine as the water level in the intake rises or falls beyond certain predetermined levels. The motor will also be connected to shut down the unit in case the plant should be disconnected from the main transmission system. A spillway into the by-pass already mentioned is provided at the intake to the wood-stave pipe, so that when the unit is shut down in case of a runaway the water automatically rises and discharges through the by-pass into the reservoir, thus causing no interference with the supply of water to the No. 1 power house.



MAP OF CRANE VALLEY SYSTEM

These plants utilize undeveloped heads of water in a system already constructed and thus provide an additional 1400 kw. to the generating capacity at a minimum of expenditure inasmuch as the conduits and dams were of 10 tons.

already constructed and the additional expenditure required was simply for the generating units, buildings and accessories. Induction-type generators were chosen because of the small amount of switching apparatus required and the minimum of attendance necessary to their successful operation. No operators will be provided in either case. The reservoir tender at the No. 1 forebay will occasionally visit the plant at that location, and the Crane Valley dam tender will likewise look after the plant at the Crane Valley dam portion of the San Joaquin system, in which induction-generator plants are being installed.

Attitude of Central Stations on Rates

Economic Conditions Due to the War Cause Changes in Rate Making—Discussion as to the Extent and Duration of the Changes in Policies of the Companies

This article gives views of central-station officials in addition to those printed in the issue of Sept. 7, 1918, page 445. Bearing directly upon the great question of the effect of companies given below recognize that far-reaching much general interest.

RATE questions will have an important part in the policies of the central stations during the changes which are to be anticipated. The views of officials of companies given below recognize that far-reaching economic changes are possible.

RATE INCREASES AN ECONOMIC NECESSITY

Alex Dow, president Detroit Edison Company, said that the rate increases by electric utilities are an economic necessity, resulting from the high operating costs arising from the war. Without more revenue than they received under the old conditions the utilities cannot continue to render satisfactory service.

ECONOMIC CHANGES TO LAST MANY YEARS

The executive of a large company states to the ELECTRICAL WORLD that he expects the economic changes due to the war will last many years. He doubts if even such recent lighting rate advances as 0.5 cent per kilowatt-hour, on a 7-cent or 8-cent basis, will be restored to the old levels. Coal cost bids fair to remain higher than in 1914, and so does labor expense. Higher rates, relatively, tend to induce more care in use of electricity, to cut down income and make net operating revenues lower. Recently renewed power contracts show bills from 50 per cent to 100 per cent greater in some cases owing to increased cost of coal. This executive is not very optimistic regarding future net revenue prospects.

CONVINCE THE PUBLIC BY DIRECT ARGUMENT

Morse DellPlain, vice-president and general manager Northern Indiana Gas & Electric Company, Hammond, Ind., in replying to the inquiry of the ELECTRICAL WORLD, says:

"I believe that the conditions prevailing at the present time with regard to central-station costs will mean a permanent change in central-station policies as to rate making.

"One feature which present conditions have emphasized is the necessity for making rates, especially those which deal with competitive business, of such a form as to allow enough flexibility to provide for changes in the cost of service.

"In spite of the many arguments advanced by public utilities in favor of basing their rates on the 'value of service,' I believe that, so long as public utilities are privately owned, the general public cannot be convinced that the 'value-of-service' theory is economically sound in so far as a basis for establishing rates for electric energy is concerned.

"The public is getting more and more in the frame of mind where arbitrary rates do not satisfy its ideas in regard to charges for public utility service, and central stations must henceforth place themselves in a position to justify fully any rate which they propose to establish.

"I believe that the only rates which the public will accept as being logical, and therefore justifiable, are those which can be shown conclusively to be based on the 'cost of service.' I would go a step further and say that one of the central-station policies which is responsible for the demand for public ownership of public utilities is our insistence in using the 'value-of-service' theory in making our rates.

"To the general public the 'value-of-service' theory means nothing more or less than an effort to justify a higher return on the capital invested, and no amount of argument can convince it otherwise.

"If we are entitled to a higher return on actual capital invested, and I believe we are, we should convince the public by direct argument. I am convinced that direct argument and honest figures will accomplish far more with the general public than many of the indirect means which appear so popular among too many public utility operators."

INCREASED COSTS NOT FULLY COUNTERACTED

An official of a holding company reports that about one-quarter of the operating subsidiaries have already been granted increases in rates and adds:

"We do not believe that any general rule may be laid down as to the amount of the increase warranted, inasmuch as our properties are distributed and the conditions brought about by the war have affected different localities to a greater or less extent. We have generally found that the rate increases amount to about 15 to 20 per cent.

"The commissions have been inclined to view our applications from a practical standpoint, and as yet we have experienced no serious difficulty in securing the increases already applied for, and we expect to apply for increases on the remainder of our properties as rapidly as the information can be compiled in a proper manner for presentation to the respective commissions having jurisdiction.

"As a general rule the increases which we have secured offset the increase in fuel, and possibly in some

instances a portion of the increased cost of labor and supplies, but have not fully counteracted all of the increases in operating and general expenses.

"So far the rate increases which we have obtained have applied to all rates in effect with the exception of rates for municipal service, but not to all classes to the same extent.

"The present emergency will undoubtedly preclude the commissions from giving each rate increase the detailed consideration which they have felt warranted in giving in the past, and undoubtedly if the results of the present increases are satisfactory, this will tend to eliminate some of the extensive investigations that have been previously thought necessary."

POWER LOAD WILL CONTINUE LARGE

George W. McQuilkin, Jr., assistant general manager Central Power Company, Canton, Ohio, expects that the power load of central-station companies will continue to be large after the war. He writes:

"It is my opinion that the present war conditions will not have any effect on the rates and rate-making policies of the central station in the immediate future and in the period after the war. Practically every central-station company of any size is operating from 50 per cent to 90 per cent (the latter being our percentage) of war business.

"It is just possible that the utilities commission will act most promptly in the approval of rates and probably will issue mandatory orders that the central stations must change their rates before facing a deficit of revenue due to the increase in the price of material and labor and principally coal cost.

"It is very probable there is going to be such a large power load on the lines of the central-station companies after the war that future development will be largely confined to residential business. This will be necessary in order to offset the bulk quantities of power that will be wholesaled at low rates."

INCREASED RATES DO NOT OFFSET INCREASED COSTS

An official of one of the large holding companies, operating a number of properties, says:

"All of our operating electric companies have obtained or are now seeking increases in rates to overcome higher costs in operation. We find that, in almost every case, there is a willingness on the part of the public, or the commissions, to allow some increases, although usually not as much as asked for. The rate of increase varies widely from about 10 per cent to approximately 30 per cent.

"The increases in some places apply to nearly all classes of business, while in others they apply only to the power business. In hardly any of the cases did the increase fully offset the increases in operating costs. In some cases substantial changes in rate-making methods will be the eventual outcome of present conditions. In other cases present methods may continue for some time to come."

COAL CLAUSES WILL STAY PERMANENTLY

Fred H. Smith, assistant general manager of the Worcester (Mass.) Electric Light Company, says:

"I do not expect the present level of electric utility rates to go back in general to the pre-war level after the war. They very probably will drop in time to a minimum at least 25 per cent above pre-war rates. I expect that coal clauses will remain permanent features of power contracts and do not anticipate normal coal prices again, measured by 1914 standards. Lighting rates will go pretty nearly back to pre-war bases, in my judgment."

STRENGTH OF THE CENTRAL STATION

An interesting forecast of long-lasting economic changes is contributed by the official of a company operating combined hydroelectric and steam plants, as follows:

"It is my opinion that the policy adopted will be determined largely by local conditions. For instance, in our own case we have had for a number of years rates which were exceptionally low for combined water-power and steam generation, and after the war period it is my opinion that our present rates will be sustained for a considerable length of time, or at least until improvements in the art of generation and additional water supply and coal supply can be obtained which would produce a reduction in generating costs sufficient to warrant reduction in price. Economic changes due to the war will cause with us a change lasting for many years in our rate policy. This change with us is manifested principally in power rates, and it is my opinion that throughout the country retail and wholesale power business has yielded the largest increase in rates.

"There have been many economic changes due to the war which I believe will continue for a long period of time. It is my opinion that these economic changes will reduce the power of competitive business to gain any strength to meet the economy and adaptability of electric energy for light and power uses.

"There remains, however, the great field of heating (reduction furnaces) into which as yet the electrical industry has not thoroughly plunged except in certain sections of the country. Whether there will be sufficient development of water power and other generating plants to warrant meeting competition in this field or not is a matter of some uncertainty."

We have not asked for exemption thus far for any employee. We have helped each drafted man to put his affairs in order, and we have recommended and helped into the service men who had not been drafted but who were the type of men that the government asked us to find. We propose to continue along these lines, although we cannot tell how long we shall be able to do so, particularly in view of the changes in the army law. So many men have gone now from all departments, and so many of our highest skilled and ablest men have gone, that we are seriously feeling their loss. But we are proud of all Edison men, both those who have gone to serve the nation directly and those who are serving the nation by sticking to their every-day job—which is not always the easier thing to do.—*Alex Dow, President Detroit Edison Company.*

Power-Factor Correction—An Urgent Necessity

Overlapping of Fall Lighting and Power Loads Together with Fuel Scarcity May Curtail Power Unless Power Factor Is Improved—Causes of Low Power Factor, How to Locate Them and the Proper Remedies to Apply

BY WILL BROWN
Electric Machinery Company

In the last issue of the ELECTRICAL WORLD the writer called attention to the urgent necessity of the producers and users of electricity improving power factor if adequate power is to be expected this winter and if maximum use is to be obtained from equipment. The deleterious effect on the entire electrical system is referred to, and typical examples are given of plants that are suffering because they neglected to consider power factor. This article and succeeding ones will point out how causes of poor power factor can be looked for and removed.

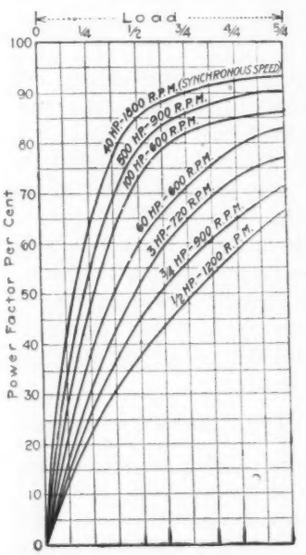
WHILE certain types of alternating-current apparatus are undesirable in point of power factor, they have not been generally developed commercially or if they have they are not used extensively. Therefore the usual cause of poor power factor is not so much the result of poor design as it is of poorly planned installations. This is evident from the fact that most commercially developed induction motors produce a power factor as high as 90 at full load and never much lower than 75 in the smaller sizes and lower speeds. On the other hand, however, if the motors are incorrectly applied to the machines (that is, if the average load is much less than the rated load of the driving motor), the power factor will be considerably lower than it would be if the motor were properly loaded as shown by the accompanying curves. Thus it may be seen that unless careful attention is given to diversity of load in grouping machines and to actual power requirements, very low power factor may result, especially since it is usually the practice to provide a liberal margin of power instead of to depend on the overload capacity for carrying peaks. What is true of induction motors regarding power factor is also true of nearly all alternating-current apparatus—the farther below rated load it is operated the lower the power factor produced. Single-phase arc furnaces are sometimes productive of low power factor even when working at normal rating.

Some engineeers argue that individual drive is best because then motors can be selected for a definite load and can hence be operated at the best power factor as well as the best efficiency. Others maintain that the advantage which can be taken of diversity makes group drive preferable because such a large margin of rating does not have to be provided for peak loads. Each argument has something in favor of it, but it will usually be found that the average load on a well-applied group-drive motor is closer to the motor rating than is the case with an individual-drive motor, so the resulting power factor must necessarily be better for group-drive motors.

The application has a great deal to do with the results, however. Among the principal breeders of power-factor troubles are hoist motors, which draw a large current in starting, and individual drive motors that require large amounts of power in starting and carry fluctuating loads. For instance, with reciprocating pumps it is not uncommon for the load to vary from zero to full load periodically. Meanwhile almost as much current is drawn from the line at part load as at full load.

In textile mills where many small induction motors are driving individual machines there is also apt to be low power factor. This typical example comes from an official of the Titusville (Pa.) Light & Power Company:

Several years ago as manager of a central station I made a contract with a new silk mill for power at a rather low rate. Instead of group drive, which we thought the mill owners would use, they installed some 350 or 400 ½-hp., three-phase motors, one to each loom. When a loom was started it required very little power to keep it in operation, resulting in a 35 per cent power factor and a 35 per cent load factor during period of operation, fifty-four hours per week.



PROBABLE POWER FACTOR WITH INDUCTION MOTORS

We ran a special circuit from our plant to a substation at this mill, which was situated close by, and installed in the substation three 100-kva. transformers. When the mill was not in operation and no energy was being used, our instruments showed that the silk-mill circuit was using in capacity and core losses 25 kva., about 5 kva. of which was core loss, the rest being due to the low power factor of the unloaded transformers. As there were some motor-driven fire pumps connected, it was impossible to cut out the circuit during the time the mill was not in operation. Under these conditions this was a very poor contract for us.

This matter was discussed at the 1910 meeting of the Pennsylvania Electric Association. At that time I found no company in this state penalizing a customer on account of lower power factor. Since then I have endeavored. wherever it is possible to do so, to place large power customers on synchronous converters or synchronous motor-generator sets. It is usually possible to do so as most manufacturing plants desire variable-speed motors.

Low power factor may also be produced by using direct-connected induction motors to drive low-speed machines like compressors. At Punxsutawney, Pa., for instance, there is a certain railroad shop where four 100-hp. induction motors were driving air compressors. These reduced the power factor at the plant to .65 or 70 per cent, causing considerable trouble owing to insufficient fuse capacity and excessive overload at the power house. These power users have now installed

synchronous motors which float on the line and correct the power factor. It would have been much better from all standpoints if the original compressor motors had been of the synchronous type.

Where direct-current power is required it has often been the practice in the past to use direct-current generators driven by induction motors. These always give considerable trouble because of the reactive (wattless) component they produce. The following extract from a report concerning the Jamestown (N. Y.) Light & Power Company describes a case in point:

> There was a certain large power consumer who had ordered a 200-hp. induction motor-generator set. We immediately showed him that he could improve his power factor by installing a synchronous motor-generator set. He changed his order and took a synchronous motor of a larger capacity, which gave a surplus beyond the actual power required and gave a lot of condenser capacity for power-factor correction. We gave him a better rate for this, which made him see that he could afford to pay the additional cost of the motor. He is glad that he made the change.

Line shafts driven by induction motors are frequently responsible for power-factor troubles, because the load is bound to be somewhat variable and the motor must be of ample size to take care of short peaks. Of course, the diversity factor generally allows the motor to be smaller in capacity than would be required for individual motors driving the same loads. Whenever the motors are running underloaded, however, they produce comparatively poor power factor. Examples of this are seen in large rubber factories in Akron, Ohio, and other centers, practically all of which have installed synchronous apparatus of sufficient capacity to counteract the lagging power factor produced by the slip-ring motors on the line-shaft drives.

How Lagging Power Factor Works in a Circle

Lightly loaded transformers introduce considerable reactance in a circuit. Here we can see the effects of lagging power factor working in a circle. When power factor is low, excessive current must be carried and this necessitates larger transformers. These transformers in turn, when lightly loaded at off-peak times, tend still further to lower the power factor on that feeder circuit. Many of these oversized transformers scattered over a system have considerable to do with lowering the over-all power factor.

Regarding this cause of low power factor, the Penn Central Light & Power Company states:

> We have had several cases of trouble with power transformers caused by low power factor, the transformers being overloaded in kva. while the actual output in kw. was far below the transformer rating. We have also experienced some trouble with overloaded lines due to highly inductive loads.

While poor power factor is usually a result of negligence in planning an installation, it is now being caused to a great extent by the inability to secure the right size of motor for an installation. Since the principal problem before manufacturing plants has been to produce quickly, they have installed larger motors than necessary where it was difficult to secure the right size, being willing to invest more money and forego the better efficiency and power factor of the correct motor for the more expedient method.

In other cases poor power factor has resulted because of change of load due to change in use of machines. This has no doubt contributed considerably to the poor factor now obtained, since many plants have changed their business entirely to engage in war service, utilizing their old equipment, but for entirely different duties.

Even those which have not changed their ordinary business may handle such totally different products one month from what they do another that the average loads on the motors, and consequently the power factors, will be considerably altered. The improper use of starting and speed-control devices may also cause poor power factor.

What to Do When Poor Power Factor Is Evident

When it becomes evident that there is a condition of bad power factor something should be done to discover the real sources of trouble. For the central station it is relatively simple to locate the general sources by means of permanently or temporarily installed power-factor meters in the industrial plants it serves. (The Wisconsin Light & Heat Company says: "The power factor of any customer's load, where we have any doubt as to its being maintained at the proper figure, is tested by temporarily installing the necessary graphic power-factor meter.") To locate the individual causes will take more time but will not involve the use of many or expensive instruments. This last task is really up to the industrial plants, although they might be instructed how to conduct tests if they are not well enough equipped with electrical engineering help to undertake them alone.

Plants which have separate feeders to each motor with ammeters, voltmeters and wattmeters, etc., permanently installed on each circuit can determine the power factors of their motors so readily that these will be passed over. Many plants, however, have feeders running to different distributing panels and have no instruments on each individual motor. In such cases portable test sets can be quickly rigged up at small expense and arrangements made so they may be connected in circuit without interrupting service. This detail can be left to each individual's ingenuity, although one or two methods which might be used will be mentioned.

For example, arrangements can be made for clamping test cables to the jaws and hinges of the motor's main switch, and then when everything is in readiness for making the tests the main switch can be opened and readings taken. Instead of clamping the testing cables to the switch jaws, they might be attached to the end contacts of blown fuses inserted in the regular fuse clips. Of course, in such cases fuses rated to protect the motor should be included in the test circuit, and in any case the instruments must be of such size that they will not be injured.

Since load surveys should be made periodically, it would be advisable to arrange the main switches for ready connection of the testing equipment. For the same reason the testing equipment should be assembled permanently in portable form. As power factor is so closely associated with the load factor of motors, it will usually be satisfactory to test only for load to see if it is near the rating of the motor, unless there is some question as to whether the motor is the proper type to use. To obtain records which will be suitable as

a basis for making changes, graphic charts should be taken, and preferably over a period which will include all ordinary fluctuations.

Such records will not only indicate which motors are responsible for the poor power factors but will also give a basis for replanning the motor drives. Although at first it may be necessary to select the size of motor on the basis of the power requirements as given by the machine manufacturer, it would be advisable finally to determine the nature and magnitude of the load by careful tests and then readjust the motor drives to agree therewith.

The power factor of other apparatus than motors can be determined in a similar manner.

How to Correct Power Factor

If the poor power factor seems to be due to some inherent characteristic of the apparatus operated, about the only remedy is to have the manufacturer adjust it or else provide some corrective apparatus such as synchronous motors, synchronous condensers or static condensers. When time is limited these remedies are particularly effective, as they may be applied without interrupting service. In view of the fact that synchronous motors can now be used for various applications* as well as power-factor corrective purposes, it is well to bear them in mind when making new installations and decide whether they should not be installed in the first place. Since most cases of poor power factor are due to poorly planned induction-motor drives, the remedy is to make use of load rocords in reapplying them. From such records it can be determined whether individual or group drive is best and which machines should be grouped together. The selection of group or individual drive and the grouping of machines depends on so many factors that they will not be discussed here, but the reader is referred to other articles which have appeared in different issues of the ELECTRICAL WORLD. In this connection the writer does wish to emphasize, however, that care should be exercised in selecting the type of motor to use and then so to apply the motors that they will operate as near rating all the time as possible. Sometimes substituting a smaller motor for a large one and equipping it with a flywheel to help carry the peak loads will improve power factor.

Individual motor drive can often be carried too far. There are times when improvement can be brought about by combining a number of machines to be driven from the same line shaft. In some cases a synchronous motor of liberal capacity, either belted or directly coupled, could be installed to drive the line shaft. This would serve the double purpose of providing ample power to carry the load over all peaks and providing additional condenser capacity at periods of light load for supplying magnetizing kva. to the rest of the system. Whatever slight losses or inconvenience might be caused by the belts and shafting would be more than offset by the decreased I^2R losses throughout the plant. The result would be better voltage regulation and possibly a better rate for maintaining higher power factor.

It is interesting to note that numerous plants have been saved from power-factor troubles by the use of synchronous motor-generator sets. Many central-station companies have induced customers to install synchronous motors of sufficient kva. rating to maintain at all times a power factor of 90 per cent leading (or lagging) while driving the direct-current generators.

How to Encourage Power-Factor Improvement

Decreased efficiency itself is not always a sufficient spur to make the plant owner look for a remedy. The possibility of not getting any power at all unless correction is made may wake up some indifferent power users. On the basis that poor power factor is usually caused by underloaded motors another inducement can be advanced—that improving power factor will release equipment to take on new loads caused by growth in business. Possibly a penalty for low power factor is needed to make some factories act. Plant owners would discover that they could put in smaller motors and move the old motors up to larger loads, and thus really save money on original motor costs. They would also obtain a better rate for good power factor. The power-factor penalty clause would not remain as a fixed charge against factory production, but would bring about increased savings both to the power customer and to the central station supplying the power.

As an example of the savings effected by proper changing about of induction motors, the Lockport (N. Y.) Glass Company was able to bring its power factor from 70 per cent up to 88 per cent or better by reason of tests and recommendations made by competent engineers. This plant has made a saving of approximately $2,000 a year in its power bill.

The Department of Public Utilities, Division of Light and Heat, Cleveland, Ohio, makes the following statement:

> We have among our power consumers any number of power plants ranging from 50 kw. to 1000 kw. each whose power factor has been raised from 5 per cent to 20 per cent by our engineering department coöperating with the engineering department of the consumer. This consists in the rearranging of motors and their connections with a view to preventing excessive idle running equipment.
>
> Where synchronous motors can be advantageously used and the consumer can be shown such advantage he is induced to make the necessary expenditure. We find that this practice together with that of inducing the consumer to maintain a high load factor has resulted in a very material benefit to our plant, the average power factor being approximately 86 per cent and our average daily load factor for a year being close to 70 per cent.

The Cleveland Electric Illuminating Company relates the following instance:

> A certain 2300-volt feeder was overloaded and the terminal pressure was low. A 100-kw. load fed through a synchronous motor-generator set was added and the set operated at about 70 per cent power factor leading. The total load on the feeder in amperes dropped to below full load, the kw. load increased 20 per cent, and the pressure came back to normal. The line losses in this feeder were reduced by half, and savings in losses were made between power house and substation as well.

Among the many large central stations now suffering from power shortage due to war conditions the Public Service Electric Company of New Jersey is a typical example. It states its experience as follows:

> We have been making tests of our larger customers' operating conditions, with an improvement of power factor in mind. As showing how this works out in actual practice, a prospective power customer desired 50 kw. for motors. On account of shortage of generating and transmission-

*For applications to which synchronous motors are suited see ELECTRICAL WORLD, March 23, 1918, p. 604.

line capacity, due to abnormal war demands, we could not furnish the power. However, we entered into an agreement whereby the customer would install a 112 kva., 2400-volt, two-phrase synchronous motor to drive the existing 50-kw. direct-current generator, thereby releasing 50 kw. in boiler and engine capacity to be devoted to a single heavy drive. The equipment is now being installed, and our company is satisfied that the 62 kva. to be devoted to power-factor correction will nearly offset the demand required to drive the generator.

CASE WHERE SUGGESTIONS WERE NOT FOLLOWED

J. S. Jenks of the West Penn Power Company tells of a certain power consumer whose plant was considerably over-motored. Mr. Jenks himself made an investigation of the plant and found that the ratings of the machines and the motors happened to be so related that if the largest motor were removed and the other motors moved up in succession to larger machines they would be in about the right proportion for the machines they were driving. It so happened that the gear ratios allowed this change. The power company then tried to induce the plant manager to arrange his motors on this basis and to equip his largest machine, a compressor, with a synchronous motor to compensate for the wattless component of the rest of the induction motors when they would be running light. However, since the power company had no penalty clause regarding power factor in its contract, it was unable to do anything with the customer. The power company was forced to put up larger transformers and reinforce its lines in order to carry the reactive component of this load back to the substation, where it was operating synchronous condensers.

WRITING POWER-FACTOR CLAUSES IN CONTRACTS

In order not to be confronted with this obstacle to power-factor improvement, many central stations have embodied power-factor clauses in their contracts with industrial plants. The writer has on file scores of such contracts, but the following one only is quoted, as it is typical of the policy companies are now adopting all over the country. This supplement is attached to all power contracts of the Central Illinois Public Service Company:

> The company undertakes to supply the energy called for by this agreement at a power factor of approximately unity, but it will permit under the prescribed rates the use of apparatus which shall furnish during normal operation an average power factor not lower than 90 per cent, either lagging or leading, in the accepted technical meaning of these terms, and the annual maximum demand shall be based on these conditions.
>
> The company shall have the right to make a test at any time and from time to time to determine the average power factor during normal operation, and if it be found on any such test that the average power factor is less than 90 per cent, either lagging or leading, then in such case the annual maximum demand shall be made to cover the added investment in generating equipment, transmission lines, transformers, etc., necessitated by the lower power factor.
>
> In case the consumer by changes in this installation or by methods of operation shall improve his average power factor, he shall have the right, upon serving written notice to the company, to have the power factor during normal operation tested in the presence of his representative, and the company will then base the annual maximum on the results of such test, provided that not more than four tests may be requested in any one maximum-demand yearly period of this agreement.

WORK OF ENGINEERS AT ST. MIHIEL'S HIGHLY PRAISED

Tribute from Major-General Edwards to the Qualities Displayed and the Results Accomplished by Them in the Operation Against Salient

Col. George W. Bunnell, who was president of the Power Construction Company, Worcester, Mass., before leaving for France, and who commands the 101st Regiment of Engineers in the American Expeditionary Forces, has received a letter of commendation from Major-General C. R. Edwards, commanding the Twenty-sixth Division, regarding the part the engineer troops played in the reduction of the St. Mihiel salient in September. This division pushed through practically unknown enemy country from Les Eparges to Vigneoulles, a distance of 14 km., in two days, and in his letter General Edwards said in part:

"In a brilliant dash of this sort the advancing troops are always hailed with the acclaim which they well deserve. The multitude applauds them. But to those of us who know the inside points of the game there comes the thought of those others without whom the success could not have been accomplished.

"The duties of the engineer troops seldom lead to the path of glory. Their labors and the fruits of them are seldom recognized by the laymen. But there are some of us who know of the work which your regiment has done. In this last advance I cannot compliment you too highly on it. The 101st Engineers not only did the pioneer work at the front, which was their specific duty, but also repaired the roads in the rear, which should perhaps more properly be done by corps engineers. Your officers and men repaired roads that were filled with shell holes, wire and other obstacles, roads which in some cases were entirely obliterated. They accomplished their mission in a minimum of time under difficulties which seemed insurmountable. They continued their work day and night, laboring unceasingly under fire, making it possible to carry ammunition and supplies to the troops, that they might hold the ground that they had taken. Without the supreme effort of your regiment our work would have gone for naught."

Readers of the ELECTRICAL WORLD will recall that a considerable part of the system of the New England Power Company was designed and built under Colonel Bunnell's direction.

It should perhaps be added that, while General Edwards' tribute applies specifically to one regiment, it is equally expressive of the appreciation our high command feels toward the work of the engineers throughout the American armies in the war zone.

The great business that we are all connected with is really the central-station business. I don't care whether a man be a central-station man or an electrical manufacturer or an electrical jobber or an electrical supply dealer, none of us can build up successfully and permanently his own particular business unless that portion of the business which is fundamental, namely, the production and distribution of electric energy, continues to be a successful business.
—Samuel Insull.

Arrangements to Avoid Operating Difficulties—II

Description of the Turbine Room at the New Dayton Plant—Electrical Features Are So Designed as to Assure Great Flexibility of Operation—Switchboard Laid Out on Oval Plan—Novel Characteristic of Lighting Plan

THE two 12,500-kw. turbines in the new plant of the Dayton (Ohio) Power & Light Company, which was described in part in the ELECTRICAL WORLD for Oct. 19, are of the nine-stage Curtis horizontal type. At 200 lb. (14 kg. per sq.cm.) gage pressure, 125 deg. superheat and 1 in. (25 mm.) absolute back pressure, these machines are guaranteed to have the following economy:

Load (kw.)	Steam per Kilowatt-hour (lb.)
6,250	12.4
9,375	11.95
12,500	12.4

As the station now stands there is room for a 25,000-kw. machine in the turbine room.

The condensers for the two units already installed are of the two-pass Westinghouse surface type. The circulating pumps are set directly on the intake pipes and are driven by a motor on one end of the shaft and a turbine with a reduction gear on the other end, so that a heat balance can be obtained at different plant loadings by throttling or opening the control valve to the turbine and proper use of other motor-driven auxiliaries. Each pump is operated as a separate unit. The air pumps for the condensers are of the Le Blanc type.

The peak load of the company on its former stations was 21,000 kw., but this does not represent the full height to which the peak would have gone had it not been suppressed last winter. A voltage of 6600 was chosen for the generator potential, because so much of the company's load was already distributed at this pressure and because it was such a short distance from the plant to the city. Moreover, the necessity of a transformation to arrive at 33,000 volts for the company's large outlying transmission system would not have been relieved by going to any available standard potential higher than 6600 volts.

THE ELECTRICAL END OF THE STATION

Each generator is equipped with a compound-wound interpole exciter on the main turbine shaft. In addition to this there is one 100-kw. Westinghouse turbine-driven exciter in the turbine room. This is driven through a reduction gear.

A feature of the electrical end of the turbo-generator is that the main leads are brought out through the base of the turbine into a terminal chamber above the floor level. This makes the leads more accessible. The generator is Y-connected, and the neutral is brought out, but it is not used for any purpose.

The arrangement of electrical circuits has been worked out to give great flexibility of operation. A one-line diagram of these circuits and connections is shown herewith. The generator leads are taken through tile ducts below the floor to the generator oil switch on the first floor of the four-story electrical gallery. From the oil switches the cables go through ducts to the current-transformer pits in the floor and thence will later go to the middle point of the generator reactors, when these are installed. From each end of the reactors they will be taken through disconnecting switches, oil switches and a second set of disconnecting switches to the buses on the second floor. In parallel with each generator reactor is another oil switch for tying the ends of the buses together to complete the ring system when the generator is not in operation.

The bus is laid out in the form of a six-section ring. Three sections are on the north and three on the south side of the station. The feeders are arranged in groups of two, which can be connected either to the north buses or to the south buses through a system of feeder group selector oil switches. To facilitate this arrangement the

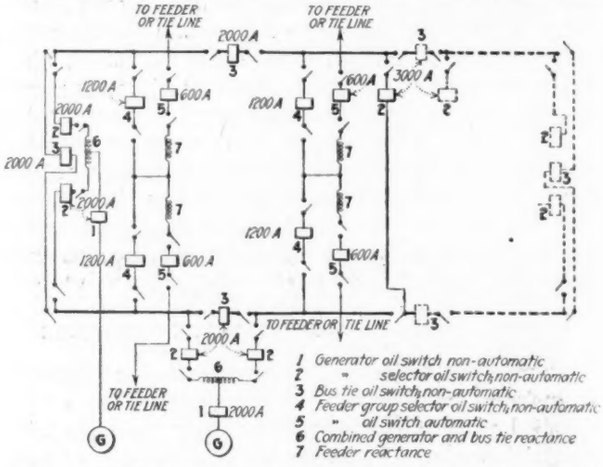

TO FEEDER OR TIE LINE
TO FEEDER OR TIE LINE
2000 A
1200 A
600 A
3000 A
TO FEEDER OR TIE LINE
TO FEEDER OR TIE LINE
1 Generator oil switch non-automatic
2 " selector oil switch, non-automatic
3 Bus tie oil switch, non-automatic
4 Feeder group selector oil switch, non-automatic
5 " oil switch automatic
6 Combined generator and bus tie reactance
7 Feeder reactance

FIG. 1—FLEXIBILITY OF WIRING SHOWN IN ONE-LINE DIAGRAM

north and south buses are tapped through oil switches to a common point, where connection is made to feeder oil switches and current transformers. From here the leads are taken through three-conductor, lead-covered cable to the distribution tower outside of the station. The feeder oil switches and current transformers are on the third floor of the electrical gallery.

All oil switches except the generator switches are provided with manually operated disconnect knife switches on each side. Moreover, all feeders which cross the river on towers are provided with means for disconnections on both sides of the river span, so that this section of the line can be isolated when men have to work upon it. Air-break switches are used for making this disconnection on one side of the river and G. & W. disconnecting potheads are used on the other.

Automatic protection is a feature of the feeder layout. This consists of induction-type, definite-time-limit overload relays and trip free relays. The latter were installed to hold switches in the open position when short circuits which cause the switches to open originally are still on the line at the time an attempt is made to reclose the breaker. Only four sections of the switching equipment described have been installed, but tile ducts and iron conduits for all are in place.

The oil switches are all of the remote-controlled solenoid-operated type. Direct-current energy for operating these switches is supplied from a 116-cell, 160-amp.-hr. "Exide" storage battery which is charged by a 12.5-kw. motor-generator set in the switchboard room. All of the oil switches are non-automatic except the feeder swiches. For the generator oil switch, generator selector switches and bus-tie switches Westinghouse type O-2 units are employed. For feeder-group selector switches Westinghouse type E-8 and for feeder switches Westinghouse type E-6 were installed. Ratings of these switches are given on the one-line diagram.

The generator reactors which are to be installed at a later date are to be of the Metropolitan single-phase type with three units installed for each turbine. When operated as generator reactors these units will provide 4 per cent reactance and when operated as bus-tie

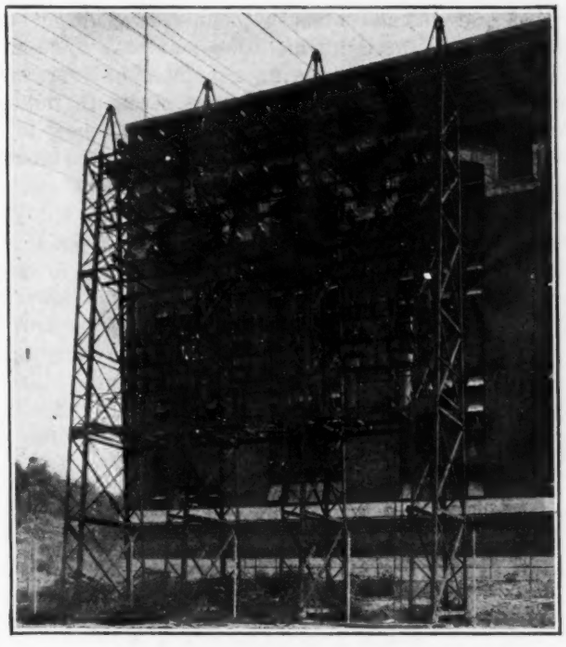


FIG. 2—TERMINAL TOWER AT NEW DAYTON STATION

reactors they will provide 11 per cent reactance. The feeder reactors are of the Metropolitan three-phase type and are rated at 5 per cent. At the present plant rating this selection of reactors will limit short-circuit current to five times normal full-load values.

The operating room, from which a view of practically the entire turbine room is obtainable, is on the third floor of the electrical gallery. It contains four sections of switchboard arranged on an elongated oval. One section is a seven-panel desk board; another is an eight-panel exciter and generator voltage regulator board; another is a ten-panel feeder switchboard; the fourth is a three-panel battery, ground detector and instrument board. This layout provides for the ultimate rating of the plant and is complete except for instruments for machines not yet installed.

The generator desk board is made up for six generator panels and one signaling panel. It controls the main generator oil switches and governor control motor. Besides the usual meters an indicating wattless component meter is used on each of these panels. On top of the desk of this board is a miniature bus with small lamps to indicate the switches on the ring bus.

On the base of the control panel is a set of signal lamps working in conjunction with signal pedestals at the turbines. These bear such signals as "stop," "shut down," "slow," "fast," "O. K.," etc. The switchboard operator also has manual control of the load sign in the boiler room, which is operated in conjunction with a bell and lamp signal each time he changes the setting.

The feeder board controls sixteen feeders, the bus-tie oil switches and feeder group selector switches. CO induction relays are used on each feeder. On the tie lines with other stations are watt-hour meters with ratchets to check the interchange of energy.

In a room adjacent to the turbine room is a seven-panel auxiliary exciter board on which rheostats and similar apparatus are installed to eliminate the necessity of carrying heavy direct-current leads to the switchboard room.

On the three-panel battery and instrument board are installed temperature indicators for all turbines, ground-detector lamps for all six buses, a graphic voltmeter and a graphic frequency meter, together with switches and circuits for the storage battery.

Station light and power is supplied through two banks of transformers. Each bank consists of three delta-connected units used for power purposes and one unit equipped with a low-voltage induction regulator for lighting. Provision has been made for another similar bank of power and light transformers in the ultimate layout. Arrangement has been made for automatically switching over a number of emergency lights at vital points around the station to the storage battery in case of failure of the usual alternating-current supply. The

INFORMATION REGARDING IMPORTANT APPARATUS

BOILERS, STOKERS, ETC.

Type of boiler	B. & W. cross-drum water-tube
Steam-making surface (sq.ft.), per boiler	13,730
Pressure for which boilers are designed, lb. per sq.in.	225
Superheat, deg. Fahr.	100
Type of stoker	Taylor
Floor space occupied by each boiler and stoker, sq.ft.	640
Coal	West Virginia high volatile
Capacity bunker, tons	975
Yard storage, tons	100,000
Locomotive crane	McMyler Interstate
Coal hoist	Mead-Morrison
Boiler-feed pumps	Platt-Sturtevant centrifugal
Feed-water heater	Platt open-type
Heater capacity (lb. per hour), each	500,000

TURBINES

Type and make	Horizontal Curtis (General Electric)
Rating (kw.), each	12,500
Steam pressure, lb. gage	200
Floor space covered by unit, sq.ft.	415

CONDENSER

Make	Westinghouse
Surface, sq.ft.	15,000
Circulating pump	Westinghouse centrifugal
Air pump	Le Blanc
Condensate pumps	Turbine-driven centrifugal on same shaft with air pump

MISCELLANEOUS

Two fire pumps.....Platt pumps driven by Sturtevant turbines
One No. 18 Peterson oil filter.
Two 500-cu.ft. Chicago Pneumatic Tool Company air compressors.
One 300-gal.-per hour Vater water softener.

GENERATOR AND OTHER ELECTRICAL EQUIPMENT

Make	General Electric
Rating	Three-phase, 60-cycle, 6600-volt, 12,500-kw.
Crane, make and rating	75-ton Whiting
Oil-switch equipment, switchboard and lightning arresters	Westinghouse

central station was designed by T. E. Murray, consulting engineer, New York. W. Weissenberger, Jr., of New York was architect. Among the contractors were the Kenn-Well Company of New York and the United States Structural Company of Dayton, Ohio.

The operating staff of the Dayton Power & Light Company consists of F. M. Tait, president and general manager; O. H. Hutchings, associate general manager; Thomas F. Kelly, commercial manager; O. B. Reemelin, general superintendent; C. H. Spiehler, engineer of power stations; J. K. Himes, superintendent of distribution, and R. D. Gillespie, chief engineer.

Joint Usage of Poles—A War Economy*

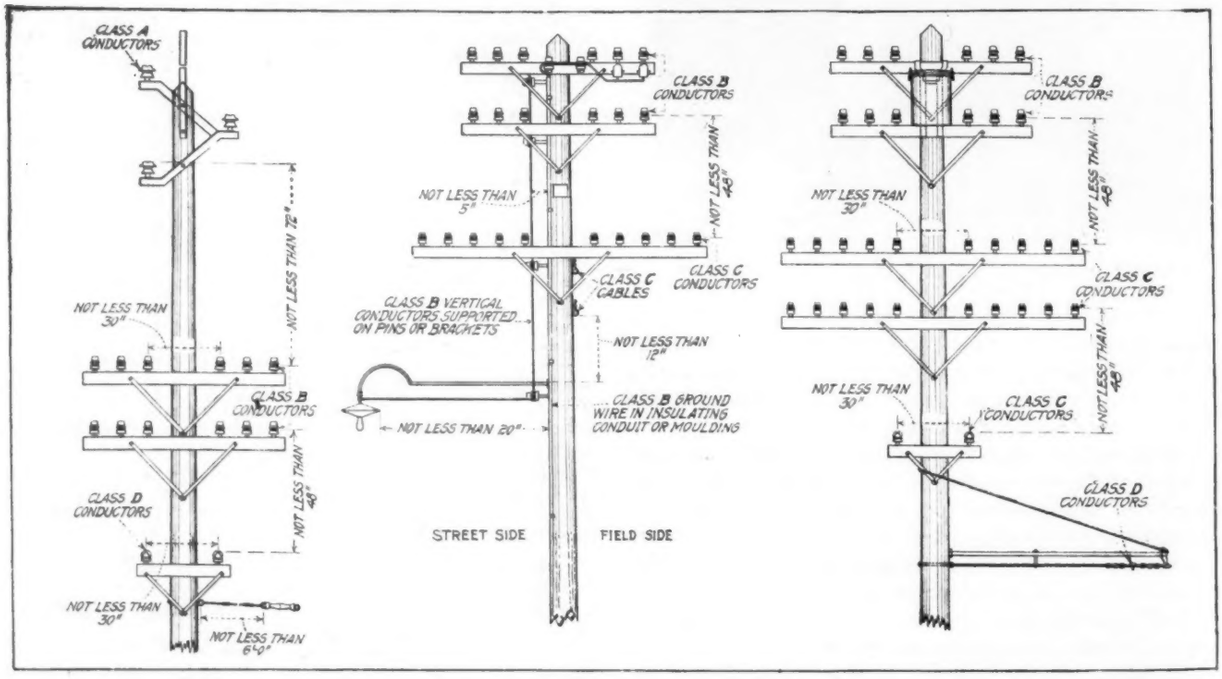
Statement of the Civic, Economic and Safety Advantages Resulting from the Adoption of This Practice—Opinions Regarding the Form of Construction Which Should Be Employed in Carrying It Out

BY T. N. BRADSHAW
Chairman of Committee Which Drafted Connecticut Rules on Joint Usage

TWO or more lines of poles erected on the same side of the street or highway are not only unsightly but represent an economic loss and a waste of timber. Where the wires on such conflicting lines are carried at or near the same level a serious electrical hazard to persons or property is liable to be created owing to the proximity of the wires of different classes and the liability of contact between them or the possibility of employees working on one class of wires coming in contact with another.

The most practical way of eliminating the losses and hazards referred to in connection with lines located on the same side of the street appears to be a properly constructed joint-use line having a well-defined space for the wires and fixtures of each occupant. These spaces should be separated from one another by an ample vertical clearance space. They should also be provided with a suitable climbing space so that employees of the various companies using the poles can ascend and descend them without coming in contact with the wires through which they may have to pass.

A wide experience covering a number of years with lines constructed as outlined above seems to indicate that the clearance space should be not less than 40 in. (102 cm.) vertically between signal wires and attachments and electric light or trolley-feed wires and attachments. Experience also shows that a climbing space of not less than 30 in. (76 cm.) wide on either the back or field side of the pole is necessary in order to provide for climbing and for the raising or lowering of transformers. It is, of course, preferable to provide a greater vertical separation than 40 in. between signal wires and wires carrying high voltages, and many companies endeavor to have this space not less than 6 ft. (183 cm.) particularly with new lines, using the minimum clearance of 40 in. only on old lines that are made



RELATIVE POSITIONS OF POWER, SIGNAL AND TROLLEY WIRES ON JOINT POLES ADVOCATED BY CONNECTICUT COMMISSION

*Paper presented before International Association of Municipal Electricians, Atlanta, Ga., Sept. 23-27, 1918, by A. L. Pierce.

joint after the line has been in service for some length of time.

The street side of the poles should always be reserved for the vertical runs of the electric light or power wires, and the field side for the vertical runs of signal wires. Owing to the fact that there is no known protective device that can be placed on a signal circuit that will afford adequate protection against the potentials carried on high-tension circuits, it is not considered advisable to place telephone, fire-alarm or other signal circuits on the same poles with such circuits. High-tension lines should wherever practicable be constructed on rights-of-way remote from those occupied by the signal lines. (By high-tension circuits are meant the following: Constant-potential, alternating-current, neither side grounded, exceeding 5000 volts; constant-potential, alternating-current, one side or neutral grounded, exceeding 2900 volts to ground; constant-current, series-metallic, line current exceeding 7.5 amp., and constant-potential, direct-current circuits including feeders and trolley-contact wires, one side grounded, exceeding 750 volts to ground.)

Pole lines located on the opposite sides of a street or highway are not considered as conflicting, but the same precautions should be observed, when erecting separate lines of poles, regarding the relative levels of the wires of different classes. That is, electric light or power wires should be carried on a taller pole line and the signal wires carried on a shorter pole line. This will enable electric light service wires crossing the streets to be carried over the telephone wires, and telephone wires from the opposite side of the street to be carried under the electric light wires. This practice prevents the interlacing of the service wires, which is liable to be a serious problem in congested streets.

In order to bring about the conditions outlined in the foregoing it is necessary to have some form of inter-company agreement covering not only specifications and methods of construction and the reservation of space requirements but also a fair division of the construction and maintenance costs. In Connecticut the matter is helped along by fair-minded legislation, and the Public Utilities Commission of Connecticut has promulgated in its Order "D" docket,† No. 1447, a set of rules and specifications under which most of the wire-using companies of the state have been operating for some time with very satisfactory results.

Since most of the lines in Connecticut have been placed on a joint-use basis and the construction standardized there has been a marked decrease in the number of fatal accidents to the employees. This is undoubtedly due to the fact that employees working on signal circuits no longer have to climb through electric light wires in order to get at their own work, and the electric light wires are generally placed so far above the signal wires that electric light employees are not apt to come into contact with grounded conductors of another class while working on high-voltage wires.

There is another feature which appears to make joint use preferable, particularly in cities and towns where there is considerable local distribution; that is, that the city or town is more completely covered by the pole lines of the two companies, and many companies have reasoned that it is better to own one-half of all the poles in a locality rather than to own all of one-half the poles.

In order to insure the success of any joint-line arrangement, particularly where electric light and signal lines are to occupy the same poles, the broadest possible coöperation must be indulged in between the various occupants for eliminating inductive interference. Electric light lines should always be kept free from grounds that might upset the electrostatic balance to ground, also long single-phase taps from three-phase circuits should be avoided wherever practicable. The voltage wave developed by the generators should be as free as possible from noise-producing harmonics, and consideration should be given this fact before the generating machinery is purchased from the manufacturer. Deviation from the pure sine wave should not be allowed to exceed the limit set by the American Institute of Electrical Engineers. These precautions are quite necessary in connection with electric light or power circuits, because it is not always possible to transpose telephone lines, for instance, so as to eliminate all inductive interference. In many instances it has been found necessary to place transpositions in the electric light or power circuits to coördinate with those in the telephone circuits.

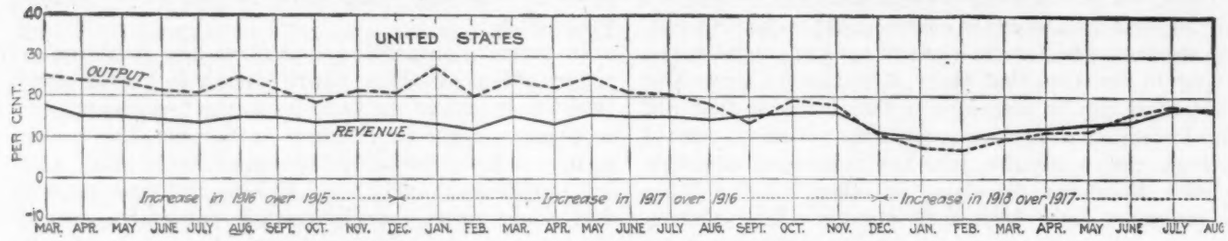
In Connecticut alone there are approximately 1700 miles (2700 km.) of pole lines used jointly by electric light and telephone or other signal lines. Practically all of this joint line mileage is standard as regards location of the wires and vertical or lateral separation, so that it is fair to say that the joint-use line is, under proper regulation, a success, simplifies the distribution problem and works toward safety.

While it is sometimes more expensive to erect a joint line, the cost to each occupant is usually less than a separate line or poles would be. The maintenance costs are also less because of this division of the charges. The lines appear to stand up better under the influence of severe storms because of the fact that such joint-use networks are usually much better guyed or braced than a single line would be. Moreover, such lines receive more attention from the engineers in order to make them satisfactory to all parties concerned.

†Can be obtained by addressing secretary of commission, Henry F. Billings, whose address is Hartford, Conn.

The conservation of coal is vital, for fuel and food will win the war, it is claimed. The conservation of coal by mining it more carefully and completely is important. But vastly more important is the conservation that comes of more scientific application and more efficient utilization, because coal in the ground is coal only, whereas coal at the point of consumption is fuel, plus labor and transportation costs and complications, and thus is of far higher intrinsic worth. Every available heat unit should be used now on the score of economy, on the score of conservation, and to reduce the congestion of the railroads and lighten their burden as much as possible.—*J. F. Christy, before the Arkansas Public Utility Operators.*

Central Station August Operations


UNITED STATES
OUTPUT
REVENUE
PER CENT.
40
30
20
10
0
-10
Increase in 1916 over 1915
Increase in 1917 over 1916
Increase in 1918 over 1917
MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG

THE AUGUST RETURNS SHOW ANOTHER LARGE INCREASE OVER THE PREVIOUS YEAR

CENTRAL-STATION returns for August show another large increase over the record for August, 1917. There is a slight falling off in the percentage of gain in both revenue and kilowatt-hour output, as compared with July, but when the increase is 17 or 18 per cent a small difference of 1 per cent does not count seriously. The increase in revenue over August, 1917, was 17.9 per cent; the increase in kilowatt-hour output was 17.3 per cent. These statistics are based on the reports of 46 per cent of the total industry. Undoubtedly the epidemic of Spanish influenza has delayed the returns somewhat.

That the electric central stations still continue their production of energy on so enormous a scale is, of course, the conspicuous feature of the returns. To show in each of two consecutive years an increase of 17 or 18 per cent over the corresponding month of the previous year in the height of summer is abundant evidence that the industry is going at top speed to meet the war needs of the nation.

It will be noted that the lines of percentage of increase in revenue and kilowatt-hour output, which have crossed several times in the last year, have again crossed in the August returns received up to this date. Now, after several months, the rate of increase in revenue is greater than the rate of increase in kilowatt-hour output. Attention has been called repeatedly to the changes and tendencies in the relative position of the two items. The change is so small that it would be difficult to draw any accurate conclusions from it.

Based on the return from 46 per cent of the industry, the ELECTRICAL WORLD estimate for August for the entire industry is: Revenue, $38,671,000; output, 2,413,480,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Aug.	63	$22,718,000	$19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.8
Oct.	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.5
Nov.	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.7
Dec.	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.0
		1918	1917		1918	1917	
Jan.	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.3
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.1
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.4
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.5
May	62	25,365,000	22,426,000	13.1	1,537,527,000	1,372,935,000	11.9
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,319,444,000	16.0
July	56	21,935,000	18,559,000	18.2	1,370,461,000	1,156,692,000	18.5
Aug.	46	17,789,000	15,086,000	17.9	1,110,201,000	946,246,000	17.3

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States			Atlantic States			Central States			Pacific and Mountain States		
		Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase
REVENUE	Sep.	64	$2,811,000	$2,362,000	19.0	64	$9,139,000	$7,963,000	14.7	53	$7,232,000	$6,177,000	17.1	87	$4,636,000	$4,355,000	6.4
	Oct.	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
	Nov.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	Dec.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb.	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April	62	2,890,000	2,578,000	12.1	59	10,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May	62	2,810,000	2,530,000	11.5	64	9,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June	63	2,925,000	2,584,000	13.3	63	10,048,000	8,761,000	14.7	49	8,124,000	6,824,000	19.0	84	4,973,000	4,432,000	12.2
	July	62	3,037,000	2,511,000	20.9	62	9,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug	59	2,965,000	2,428,000	22.1	48	7,569,000	6,633,000	14.1	27	3,452,000	2,818,000	22.5	73	3,803,000	3,207,000	18.5
KW.-HR. OUTPUT			1917	1916			1917	1916			1917	1916			1917	1916	
	Sept.	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	Oct.	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	Nov.	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	Dec.	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb.	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15.5	84	454,078,000	388,374,000	16.9
	July	62	135,960,000	105,373,000	29.0	62	518,566,000	435,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug	59	135,979,000	107,001,000	27.1	48	438,592,000	379,111,000	15.7	27	169,482,000	148,006,000	14.5	73	366,148,000	312,128,000	17.3

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PROTECTING LAGGING ON SOOT-BLOWER PIPING

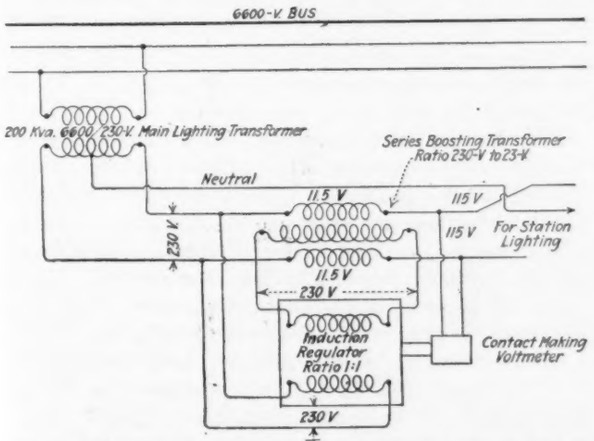
Usual Covering of Magnesia and Duck Supplemented by Galvanized Iron to Give Greater Permanence to Job

Sometimes when the side doors in a boiler setting are opened the flash of flame which comes forth is sufficient to burn the cloth covering from the magnesia which surrounds the adjacent soot-blower steam piping. The result is that the covering becomes very unsightly and the magnesia soon begins to drop from the pipes, leaving them uninsulated. Without a covering on the pipes condensation of the steam will occur, and this is undesirable in blowing soot. To eliminate this trouble the Dayton (Ohio) Power & Light Company in its new power house at Miller's Ford has covered all pipes adjacent to the doors with galvanized iron. The sheet metal is applied after the magnesia and duck are in place.

HOW TO REDUCE COST OF STATION REGULATOR

Shifting Unit Into Lower-Tension Network Accomplishes the Desired Purpose at Less Expense than Purchase of New Instrument

Conditions with the Dayton (Ohio) Power & Light Company made it seem necessary to regulate the voltage on circuits supplying station lighting in the new power house at Miller's Ford. To keep from buying a high-voltage regulator to operate at the generator potential of 6600 volts the scheme of connections illustrated here was worked out. From the 6600-volt bus these circuits were taken through the 200-kva., 6600/230 and 115-volt transformer which fed all station lighting circuits. In the outside lines of the three-wire secondary of this unit was connected a series boosting transformer with a ratio of ten to one, the high-voltage winding being designed for 230 volts and the low voltage for a total of 23 volts, 11.5 volts in each half. The high-voltage winding of the boosting transformer receives from 0 volt to 230 volts from one winding of a low voltage one-to-one ratio induction regulator, the other winding of the regulator being energized from the outside lines of the secondaries of the main 200-kva. transformer. Connections to the contact-making voltmeter as shown completed the job. The unit is now operating satisfactorily.



REGULATOR ARRANGEMENTS MADE TO AVOID BUYING HIGH-VOLTAGE UNIT

GROUND PLATE PLACED UNDERNEATH LINE POLE

Eliminates Necessity of Digging Additional Hole for Ground—Method of Connecting and Protecting Ground Lead

To eliminate the necessity of digging an additional pole for ground plates, the Binghamton (N. Y.) Light, Heat & Power Company has adopted a standard method of placing the plate underneath the pole. When the pole line is constructed the hole is dug slightly deeper than necessary and a copper ground plate 22 in. (56 cm.) by 16 in. (40 cm.) is dropped into it. A copper wire wound spirally is soldered to the plate and connected to the neutral of the line. This method eliminates the digging of an additional hole at least 6 ft. (1.8 m.) deep and provides a permanent ground for the pole as well as the line. For about 8 ft. (2.4 m.) above the ground the wire is protected by a wooden molding, which helps to prevent the wire from being broken by teams or boys.

PROVIDING FOR OVERLOADS WHILE AWAITING DELIVERIES

Rotary Converter Floated Between Overloaded Alternating-Current and Direct-Current Generators to Take Advantage of Diversity Factor

To carry a peak load of 425 kw. to 450 kw. with only 375 kw. in generating equipment has been the problem of the Pascagoula (Miss.) Street Railway & Power Company of late. Part of the load is direct-current and part alternating-current, and separate generators are used for each system. As a result each unit had to care for its own peak loads and could not be helped out by the other unit in times of stress. Both the alternating-current and the direct-current loads were of a highly unsteady character, creating high peaks, so it was believed that if some means was provided for exchange of surplus power between the alternating-current and direct-current generators considerable advantage could be taken of the diversity factor. Consequently a 150-kw.

rotary converter was connected between the two machines (150 kw. a.c. and 225 kw. d.c.).

While several engineers who had heard that this scheme was being considered did not believe it would give satisfaction, the results have been all that could be desired, according to L. J. Fohr, manager of the property. Unlike the case where the alternating-current switches of a rotary converter are opened and direct current allowed to feed back, it is possible with this system to feed energy through the converter in either direction without causing a runaway because the speed is governed by the frequency of the alternating current.

Signs of trouble are being watched for, but it is expected that this arrangement will tide over the period until the company can install an additional 500-kw. unit which it is now preparing to put in.

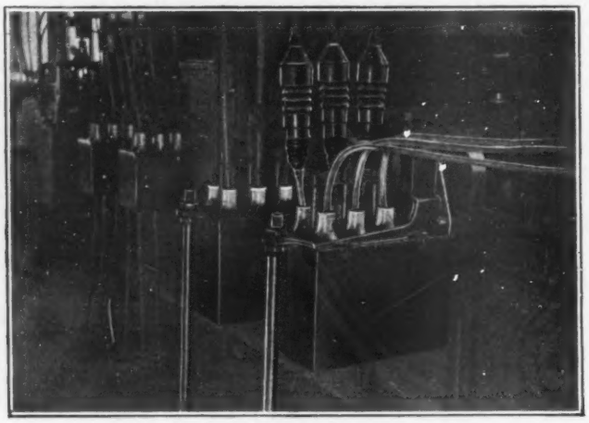
UTILIZING POTHEADS AS OIL-SWITCH "DISCONNECTS"

Disconnecting-Type Potheads Between Main Station Bus and Oil Circuit Breaker on Feeder Circuit Solve Space Problem

BY R. P. HINES

In a central generating station used for furnishing power to coal-mining operations in Kentucky the oil circuit breakers on the 4000-volt, three-phase feeder circuits were originally installed without any knife-blade disconnecting switches or other means of disconnecting the leads on either the bus or the load side. There is a common 4000-volt bus into which the alternators feed and whence the feeder circuits are taken.

After the initial installation it was desired to provide some means to disconnect the leads of one of the



DISCONNECTING POTHEADS PROVIDED TO TAKE PLACE OF DISCONNECTING SWITCHES OMITTED

feeder-oil circuit breakers from the 4000-volt bus. The first indication was to provide the usual single-pole knife-blade type disconnecting switches for this purpose, but further investigation showed that there was insufficient room to make a satisfactory installation of this type of switch, and there were also obstacles to providing sufficiently rigid supports.

It would only be required to disconnect this oil circuit breaker from the bus, in case of trouble making it necessary to repair it, so that the operation of the means employed to disconnect it would be only at infrequent intervals and not a part of the daily routine operation of the station. The G. & W. Electric Specialty Company disconnecting type of potheads were finally installed as a possible solution of the problem. They were selected on account of their small size, simplicity and ease of installation and operation, and they have thus far served as a satisfactory solution to the problem involved in this particular case.

STANDARDIZING THE RATING OF ROLLING-MILL MOTORS

Would Permit Bids Being Made on Common Basis, and Motors Could Be Designed to Best Advantage if Steel Mill Engineers Agree

Standardization of steel-mill motor ratings, so that one motor will not be called a 5000-hp. motor in one place and a 10,000-hp. (short-time rating) in another, is very much needed, said K. A. Pauly before the Association of Iron and Steel Electrical Engineers recently. This would help the steel men to compare bids on motors offered by different manufacturers.

Up to the present time it has been the practice for manufacturers to rate motors for different lengths of time and for various maximum temperature elevations. Mr. Pauly advocated using the single-standard continuous rating allowing 50 deg. C. rise, as provided in the Standardization Rules of the A. I. E. E. Further advantages of standardizing ratings are that with a common understanding of what is meant by the horsepower rating on a motor nameplate engineers will have more confidence in the size of motor advocated for any certain mill and that there will thus follow naturally a tendency toward standard capacities. In opposition to a lower temperature rise such as 35 deg. C., which has been commonly used for steel-mill motors, the author said that these motors are really worked up to a 50 deg. C. rise, but that from 5 to 15 per cent more output can be obtained from the same material if the motor is designed for a 50 deg. temperature rise instead of for 35 deg. rise and operated at overload. It is further pointed out that steel-mill engineers will soon become accustomed to the new "names" for motors and there is good reason for using A. I. E. E. standards for the new horsepower rating.

This paper was discussed by about eighteen persons, fourteen of whom favored a standard rating and five of whom went on record as ready to adopt the A. I. E. E. method of rating as proposed by Mr. Pauly. No one offered valid objections to the proposal, so it will probably be formally adopted in the near future.

J. E. Fries pointed out that a statement of the maximum torque developed by the motor may be put in specifications, but that such additions need not interfere with the single standard of temperature rise for continuous load. It was pointed out that insulation of coils does not often break down because of temperature rise, but rather owing to insufficient bracing and to dirt.

D. M. Petty suggested the appointment of a committee to draw up formal statements for the standard rating of steel-mill motors.

Some of the others taking part in the discussion were H. H. Craiglow, W. B. Snyder, Gordon Fox, H. C. Crank, D. W. Duncan, Brent Wylie, T. E. Tynes and R. B. Gerhardt.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

PAYING DEMAND-METER INSTALLATION EXPENSE

Conditions Sometimes Exist Under Which Customers Will Be Glad to Stand This Burden if Properly Approached

When a Middle Western central station began to install demand meters on its larger industrial customers' installations it found quite frequently that services were taken into the premises from two or more widely separate points. To rearrange the wiring so that the total instantaneous demand could be measured on a single meter meant a considerable expenditure. The company did not feel that it could afford to go to the expense of making the change. At the same time it realized how much to the benefit of the customer it would be if the change were made. To induce the customer to pay for the change in this wiring, therefore, was the problem.

In most cases the difficulty was cleared up by measuring the demands on the separate services and presenting a bill based on the total of the separate readings, together with an explanation of the reduction which could be made if the owner would change his wiring so that the demand could be measured at a single point to give him the advantage of his load diversity.

FREE RENEWAL OF FUSES DISCONTINUED IN HARRISBURG

Pennsylvania Utility, in Addition, Makes Charge for Visit of Troubleman to Consumer's Premises to Renew Fuses

The Harrisburg (Pa.) Light & Power Company has recently adopted a new policy in connection with the distribution or renewal fuse plugs. It had been the practice of the company to renew fuse plug burn-outs without charging. This free renewal has been discontinued. Moreover, where it is necessary for the company's troubleman to visit the customer's residence for the purpose of installing fuse plugs, a service charge of 40 cents is made to cover the visit and the installation of one fuse with a charge of 10 cents for each additional fuse installed. Fuses called for at the office by consumers are now sold for 10 cents each, instead of 5 cents, as before.

This innovation has had an immediate effect in reducing the number of trouble calls for fuse installation, while the revenue derived from the necessary calls which are still being made, and paid for, is taking care of the troubleman's time and putting him on a self-supporting basis. Special pains are being taken to instruct the consumers how to install fuse plugs in order that they may take care of their own burn-outs, and it is believed that it will not be long before most Harrisburg householders will provide themselves with extra fuses so as to be prepared to take care of any trouble which may develop. There will then be no call on the utility to send a man when it is simply a case of unscrewing a burned-out fuse and putting in a new one.

SHORT EXTENSIONS ARE FINANCED BY CUSTOMERS

Elmira Company Borrows $11 per Short Extension at 6 per Cent Interest—Loan to Be Returned as Soon as Securities Can Be Placed on Market

The problem of line extensions during war times has in most instances been solved where long extensions were to be made. Short extensions, merely connecting a service on existing line, also require capital, and the expense involved may easily run into a good many hundreds of dollars in a short time. The Elmira (N. Y.) Water, Light & Railroad Company has found a way of obtaining the required money by applying a customer-financing method to even the small extensions.

Each prospective customer is approached frankly and told of the conditions faced by the utility in war times and of the necessity for having financial assistance wherever extensions are required. It is pointed out that utilities must refrain from issuing securities at the present time unless authorized to make an issue and that consequently funds are not available for line extensions. It is further shown that the increased costs of labor, materials, fuel, etc., have reduced the net income to such an extent that financial assistance must be had from prospective customers.

However, the customer does not pay for the line but only lends the necessary money at 6 per cent for such time as the company needs it. The company guarantees to recall all of the outstanding certificates that it has issued and refund the total amount of the money that has been advanced with interest added. Care has been taken to impress upon all customers this fact that they are not buying or paying for the service, but are merely assisting the company in financing the purchase of the necessary material and labor. The company does not refuse to run any extensions, but points out to the customer that unless financial assistance is rendered the company will not be able to make the extension until some other way has been found to finance the proposition.

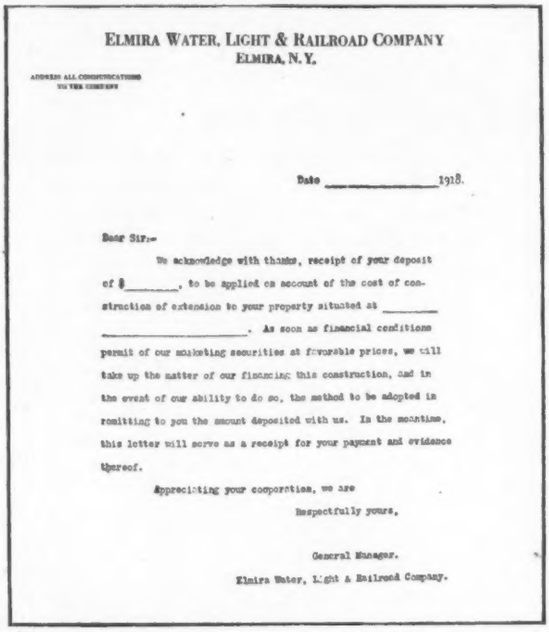
Where it is necessary to extend the wires a distance of 300 ft. to 500 ft. the company first finds out from the line department what the cost of these extensions will be. On ordinary service, however, where the secondaries run right up to the house the company has been asking the consumer to advance $11. This has been found to be about the average cost of service during the months of June and July. Prior to that time

the cost was a trifle less, the increase being due to the gradual advance in the cost of material and labor.

Should a prospective customer point out that it is impossible for him to advance the cost of the extension, he is then asked to go to the bank and borrow the money, and this has been done in some instances.

The Elmira company has been wiring about 100 houses a month this year, and in each instance the customer has been asked to assist in the service construction. Almost always he has advanced the money.

It was also found necessary to impress upon all em-



ELMIRA WATER, LIGHT & RAILROAD COMPANY
ELMIRA, N.Y.

ADDRESS ALL COMMUNICATIONS TO THE COMPANY

Date _____ 1918.

Dear Sir:-

We acknowledge with thanks, receipt of your deposit of $_____, to be applied on account of the cost of construction of extension to your property situated at _____ _____. As soon as financial conditions permit of our marketing securities at favorable prices, we will take up the matter of our financing this construction, and in the event of our ability to do so, the method to be adopted in remitting to you the amount deposited with us. In the meantime, this letter will serve as a receipt for your payment and evidence thereof.

Appreciating your cooperation, we are

Respectfully yours,

General Manager.

Elmira Water, Light & Railroad Company.

CERTIFICATE OF RECEIPT FOR MONEY ADVANCED BY CUSTOMER

ployees the necessity for taking this step so that they can speak intelligently on the subject to any one. In addition, each of the electrical contractors in the city and surrounding counties has been notified what the company is doing so that no consumer will have his house wired without being absolutely familiar with the conditions of connection to the company's mains or secondaries.

NEW SERVICE RULE BOOK NOW IN USE IN PITTSBURGH

Duquesne Light Company Issues Pamphlet for Consumers Who Are Likely to Make Changes in Their Equipment

A few months ago the Duquesne Light Company of Pittsburgh issued to the local wiring contractors and architects a service rule book. The book was not intended to be given to customers as a matter of course, but only to such users of the company's service as would be likely to have changes made in their equipment. At first the books were numbered in order to keep track of where they went, but it was later found that the work thus involved was too much and the numbering was discontinued.

In introducing the book the company makes the following statement to electrical contractors, architects and customers: "The following deals with the relation between the company and those parties who design, install and use systems for interior wiring, and gives the practice of the company in the form of rules and regulations as far as practicable. In any case where the rules and regulations are thought restrictive, the installation department will be glad to give the case individual consideration. Inspectors from the installation department will render assistance in the case of meter locations, service, etc."

The book tells where to apply for service and what systems for distribution are available in the different districts. Charges for services both overhead and underground in the different districts are made clear.

CUSTOMERS TO PAY EXCESS OVER 1914 COST ON LINE EXTENSIONS

Original Customer Refunded Normal Cost by Company at Rate of $20 per Additional Customer, and 90 per Cent of Abnormal Cost by New Customers

A new system of service charges has been adopted by the Alliance (Ohio) Gas & Power Company, effective Nov. 1, for residences and commercial loads of 5-kw. rating and less. This applies in any instance where the company is required to make an expenditure (1) for the installation or construction of additional or specific overhead lines on streets, alleys, highways, rear lot and side lot lines, including poles when necessary, and usual equipment, wire, lightning arresters, line switches, ground wires or connections, or for any work on existing poles with all of the attendant equipment for increasing the existing distribution system or transmitting direct to the applicant's premises; (2) for transformers wherever installed, excepting only standard service transformers, and (3) for construction on applicants' premises exclusive of overhead service loops, meter and any overhead or underground construction on rear or side lot lines as already described.

The applicant is required to deposit with the company an amount equal to the estimated cost of the work done upon the understanding that the work constructed shall remain the property of the company. However, a refund to the amount of the estimated cost of this work, except construction on applicants' premises, as of July, 1914 (called normal cost), will be made to the depositor at the rate of $20 for each customer's installation connected to this work within ten years. This refund shall not exceed the amount of the normal cost and shall not be payable unless written notice is given by the applicant to the company of the consumers' installations connected to this work. No interest is allowed on the amount deposited. Furthermore, the company has the right to refund at any time all or any part of the unrefunded portion of the normal cost of the work.

Moreover, each additional customer on this line connected within ten years of original contract date shall pay one-tenth of the cost of this construction above the normal cost at the time of filing his application for service, which amount shall be refunded to the original depositor until nine-tenths of this abnormal cost shall have been refunded, when such collections from applicants and refunds to depositors shall cease.

The Alliance company is a Doherty property, and it is stated that other Doherty properties in Ohio will probably follow this method, which has received the approval of the Ohio Public Utilities Commission.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Load Division Between Synchronous Frequency Changers Operating in Parallel—I.—QUENTIN GRAHAM.—The paper treats of the fundamental elements that must be considered when two or more synchronous frequency-changer sets are to be operated in parallel.—*Power*, Oct. 8, 1918.

Practical Construction of Diagrams of Operation for Three-Phase Asynchronous Motors with Short-Circuited Rotors.—J. DAMIEN.—The author's endeavor is to simplify the diagrams referred to by reducing to a minimum the number of factors of which the preliminary determination is necessary in this construction, and thus to make the employment of the diagrams immediate and rapid without recourse to complicated formulas or to remote factors such as the coefficient of distribution, the ratio of transformation, etc. His method, while not absolutely rigorous, is practically applicable.—*Revue Générale de l'Electricité*, Sept. 7, 1918.

Current Distribution in Polyphase Commutator Armatures.—T. SCHMITZ.—Investigations are made of the distribution of current in polyphase commutator armatures for simple and double sets of brushes. It appears that with the double set of brushes there are in general two groups of conductors carrying different currents. Formulas are given to calculate the currents in the conductors in terms of the current supply to the brushes, and the space distribution of the two groups of conductors is determined. The latter depends on the angle between the brushes and differs for the cases of an even or odd number of phases. Expressions are also obtained for the reactance voltage of the armature. The results obtained are applied to several examples and collected in tables.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elektrot. Zeits.*, 39, April 25, 1918.)

Lamps and Lighting

Incandescent Electric Lamps.—ALBERT TURPAIN.—An exhaustive and well-illustrated study of the history of the incandescent lamp and its development up to the present time. The following are some of the author's divisions of his subject: The carbon-filament lamp and its perfectionment; the theory of radiation; the metallic-filament lamp and its perfectionment; the construction of a bulb for the metallic-filament lamp; the filaments, including half-watt filaments; measurement and output, including lamps with carbon, Nernst, Tantalus, pressed-tungsten, drawn-tungsten and half-watt filaments; photometry; characteristic curves, and formula for ascertaining the cost per candlepower-hour.—*La Technique Moderne*, July, 1918.

Naming of Optical Glasses.—W. ZSCHOKKE.—Describes the developments which have taken place in the production of glass for optical purposes. The paper concludes with a table giving the dispersion at various parts of the spectrum for the different glasses produced at the Sendlinger works.—*Science Abstracts, Section A*, August, 1918. (Abstracted from *Zeits. Instrumentenk.*, 38, April, 1918.)

Effects of Gases and Metallic Vapors on Selenium of the Hexagonal System.—W. E. TISDALE.—It has been shown that the various light-electrical properties of selenium crystals of the hexagonal system may be altered by subjecting them to the action of different gases. The effect of the gas seems to be more detrimental the higher its atomic weight. The effect of making crystals in gases is little different from making crystals in vacuum and then subjecting them to gas. It is pointed out that the effect of metallic vapors is to form a conducting film on the surface that may under certain conditions give an apparent light-negative action to crystals that are normally light positive.—*Physical Review*, October, 1918.

Electric Force in the Mercury Arc.—C. D. CHILD.—The electric force in the mercury arc increases as the density of the vapor increases. It is approximately a linear function of the density of the vapor, but does not become zero when the density is zero. The temperatures of the mercury arc were found to be higher than those usually ascribed to it.—*Physical Review*, October, 1918.

Generation, Transmission and Distribution

Clean Coal.—In a report submitted to the National Research Council on the problem of better utilizing our coal resources, the J. G. White Company says that the elimination as far as possible of slate and other ash-forming impurities in coal before delivery to railroad cars will prevent serious economic waste in its utilization and transportation. These wastes may be briefly summarized as follows: (1) Reduction in heating value of coal due to presence of ash. The presence of ash in coal not only reduces its heating value but as the percentage of ash increases the percentage of combustible lost with the ash also increases, thus greatly reducing the boiler efficiency and hence lowering the economic value of the coal. (2) Increase in coal consumption for a given power. The reduction in boiler efficiency greatly increases the amount of coal that must be purchased to produce a given amount of work. This is a direct financial loss, since the consumer is not only paying for unnecessary ash but is losing good fuel which is carried off through the boiler grates with the excessive ash. (3) Influence of high ash on boiler capacity. The presence of excess ash seriously reduces the boiler capacity, because sufficient coal cannot be burned on the grates to do the necessary work. This is possibly the effect which is felt most seriously by the consumer, inasmuch as he finds it impossible to get sufficient steam from his boilers to do the work demanded of them and

is compelled either to reduce his output or purchase additional boiler capacity. (4) Increase in transportation equipment due to high ash. About 85 per cent of all the coal mined in this country is carried by the railroads, hence unnecessary ash means an unnecessary task given to the railroads. Each per cent of avoidable ash adds to the work of the railroads about 5,000,000 tons of unnecessary freight per annum. Some shipments of coal contain 18 or 20 per cent non-combustible. Such coal requires 65 per cent more cars and locomotives than a reasonably clean coal of say 10 per cent ash.

Steam-Boiler Regulation and Control.—ALBERT A. STRAUB.—That the proper handling of the damper for controlling the draft for steam-boiler furnaces is of great importance is brought out in this article. Charts showing the variation in the temperature of gases escaping from the boiler and of the steam pressure are shown, each indicating a condition of damper control.—*Power*, Sept. 24, 1918.

Power-Plant Management.—ROBERT JUNE.—This is the second of a series of articles by the author on power-plant problems, dealing particularly with coal and its selection. The author outlines data which would be given consideration in making up specifications for the purchase of coal.—*Central Station*, September, 1918.

Some Factors in Fuel Economy in Boiler Plants.—ROBERT H. KUSS.—In this paper data are given showing the amount of coal used under stationary steam boilers, in railway locomotives and in household furnaces. The author gives an idea of the relative efficiency attained in burning coal under these three different conditions. It is pointed out that the greatest possible saving should be made in connection with boiler plants under the control of technical engineers. He discusses particularly considerations connected with the proper draft.—*Journal A. S. M. E.*, October, 1918.

Hydroelectric Development at Rochester.—A description of a 25,000-kva. hydroelectric plant near Rochester on the Genesee River is given in this article. The development is briefly described and well illustrated.—*Power Plant Engineering*, Oct. 1, 1918.

Aluminum Transmission Lines.—J. A. MONTPELLIER.—A comparison of aluminum with copper lines, with special reference to the scarcity and cost of the latter metal in Europe. In order to replace a copper line 10 sq. mm. in section constructed for a current of 48 amp. an aluminum line of 17 sq. mm. is required. For a line 1000 m. in length the copper will weigh 89 kg., the equivalent aluminum not more than 46 kg. Supposing the price of the two metals to be the same, an economy of 48 per cent would be realized by the substitution of aluminum. This, the author says, is the actual case, adding that numerous instances of excellent results from aluminum lines more than ten years old justify its employment from the technical and the economic points of view alike.—*L'Industrie Electrique*, Sept. 10, 1918.

Installations, Systems and Appliances

Electric Welding.—H. A. HORNOR.—This paper covers a brief review of the uses of electric spot and arc welding in this country prior to the formation of the electric welding committee of the Emergency Fleet Corporation. It compares the status of the art at the present time and emphasizes the developments that have been made in apparatus in the last six months. It treats of the activities of the welding committee in applying electric welding processes to the shipbuilding industry and points the way to the general applicability of this method to other industries. It shows that the results obtained by investigation and physical tests prove that the applications of this process to heavy work are satisfactory.—*Proceedings A. I. E. E.*, October, 1918.

Performance of Electrically Driven Mills.—"Electrically Driven Mills" was the title of a paper presented by J. T. Sturtevant of the Bethlehem Steel Company at the annual convention of the Association of Iron and Steel Electrical Engineers held recently at Baltimore. The author gave data on the layout, equipment, power consumption and tonnage of eleven installations at the Lehigh plant of the Bethlehem Steel Company. These data should prove valuable for engineers desiring specific performance of electrically driven mills. Incidentally the author explained some trouble which developed with wound-rotor induction motors on the system. Frequent breakdown of rotor insulation was traced by oscillographic records to the fact that the controllers in use necessitated opening the stator windings when the rotor circuits were open, thus producing destructive voltages in the rotor windings. The trouble was readily corrected by changing the control wiring.

Construction and Operation of an Electrolytic Copper Refinery.—J. E. MCALLISTER.—A detailed description of the probable cost of construction of an electrolytic refinery to handle 50,000 tons of blister copper annually is given. Economic aspects are discussed, the basis of cost estimate is defined, proposed practice is outlined, and estimated initial and operating expenses are printed.—*Engineering and Mining Journal*, Aug. 24, 1918.

Relations Between Heating and Current-Carrying Capacities in Various Conductors.—The subject is discussed under the following headings: losses by convection and radiation, fusing effects, carrying capacities of various materials and advantages of electrical heating.—London *Electricity*, July 12, 1918.

Electric Welds.—ERNEST EDGAR THUM.—In this outline is given a brief discussion of welding machinery, and particular attention is devoted to the properties and microscopy of the welds. A peculiar occurrence known as the Widmanstattian structure is explained.—*Chemical and Metallurgical Engineering*, Sept. 15, 1918.

Earthing Power-Station Equipment.—P. H. ADAMS.—It is the purpose of the article to discuss the earth connections of station equipment and reasons for making them.—*Power*, Sept. 24, 1918.

Electric Extra Pressures and Systems of Protection.—L. LOMBARDI.—This article is the text of an experimental lecture the origin of which is to be found in the experiments made upon the artificial line already described (*Abs.* 60—1918). The author's experiments were made in order to study the extra pressures caused by sudden variations of the conditions of a line and the efficacy of the different types of dischargers. In conclusion, the author estimates that the best protection for installations consists in their rational construction in making equal as much as possible the characteristic constants of the different parts and in avoiding, especially at the ends of the different branches, the association of inductances and capacities.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elettrotecnica*, 5, May 15 and May 25, 1918.)

Electrophysics and Magnetism

Direct-Current Lifting Magnets.—J. A. MONTPELLIER.—A description of the five types of electrical lifting magnets constructed by the Société l'Eclairage Electrique for the handling of pig iron, shavings, etc., as well as of rails, bars and other finished products. Two magnets coupled in tandem are often used to good effect. The magnets are built to operate at 240 volts direct current with specially constructed controllers immersed in oil which make it possible to demagnetize the apparatus rapidly by means of a feeble reverse current.—*L'Industrie Electrique*, Aug. 25, 1918.

Simple Boiling-Point Apparatus for Testing Mercury Thermometers at Temperatures Over 100 Deg. C. —G. DIMMER.—For testing mercury thermometers at high temperatures the author recommends the use of vapor baths. The thermometer is hung in a long-necked flask which contains a suitable substance of known boiling point (aniline, 184.1 deg.; naphthalene, 218 deg.; benzophenone, 306 deg.; sulphur, 444.6 deg.). This flask is surrounded by a wider tube with a trumpet-shaped opening at the lower end. By this means the hot gases ascending from the heating burner are caused to surround the inner boiling tube and so to form a hot-air mantle which greatly increases the constancy of the temperature within the boiling tube. The bulb of the thermometer is surrounded by an inverted Al cone which prevents the condensed vapor running down the bulb. Circulation of the vapor of the boiling liquid round the bulb is, however, secured by perforating the sides of the protecting cone.—*Science Abstracts.* (Abstracted from *Zeits. Instrumentenk.*, 38, March, 1918.)

Conditions for Equilibrium in a Circuit Containing a Reactor and a Condenser.—H. GÖRGES.—If a condenser of suitable capacity be connected in series with a reactor having an iron core and an alternating voltage be applied across the combination and gradually increased, the current, the voltage across the condenser and the power taken remain small until a certain degree of magnetism of the core of the reactor is reached, when a sudden very large increase takes place in these quantities. Görges now presents a method of determining the conditions of equilibrium when the magnetization curve and the curve for the power consumption of the reactor are given. He employs a graphical construction representing the main voltage by the base of a triangle and plotting from the data the loci of the extremes of the two sides, which represent the voltages across the reactor and condenser respectively. The height of the triangle is proportional to the power consumption. He shows that for a certain range of voltage these loci intersect at two points, yielding inclosed triangles corresponding to two different states of stable equilibrium. A third point may occur at which the equilibrium is unstable. When the core of the reactor contains an air gap, only one point is found. Results of measurements are compared with the theoretically determined voltages and agree satisfactorily.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elektrot. Zeits.*, 39, March 14, 1918.)

Measurement of Dielectric Absorption. — LINDLEY PYLE.—The writer extended the time of discharge of paraffined paper condensers to many hours and shows that the total absorbed charge may readily exceed by many hundredfold that charge which is of the order of magnitude of the free charge.—*Washington University Studies*, 1918.

Electrochemistry and Batteries

Remelting of Aluminum Pig in Electric Furnace.—DWIGHT D. MILLER.—Electric melting offers advantages in control of atmosphere, temperateure and application of heat. A description is given of a plant which replaced an oil furnace, with comparison of costs.—*Chemical and Metallurgical Engineering*, Sept. 1, 1918.

Miscellaneous

Power Factor and Energy Tariffs.—A. BARBAGELATA. —Two schools actually hold the field concerning the manner of allowing the consumer to pay for the energy due to magnetizing current. One proposes to let the consumer pay at a certain rate for the reactive energy, while the other proposes to let him pay a certain price for the apparent energy. The author considers the discussion rather academic, as it is impossible to determine exactly the charge which is to be borne by the central station in each particular case, since for a given consumer's power factor the charge varies as a function of the total load of the main, of the distance of the consumer from the central station, of the hour of the day, etc. Practically both schools arrive at the same result, which consists in charging the consumer the same price both for $EI\cos\Phi$ and for a fraction of $EI\sin\Phi$.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elettrotecnica*, 5, June 5, 1918.)

Prevention of Vibration in Power and Ventilating Plants.—CHARLES L. HUBBARD.—In this article are given causes of vibration and forms of foundations, hangers, supports and connections to prevent its communication to building structure.—*Power Plant Engineering*, Oct. 1, 1918.

Applying Electricity to Agriculture.—A summary of a comprehensive report made to the French Academy of Agriculture by M. Dabat, director of the Department of Streams and Forests in the Ministry of Agriculture, in which he considers the progress made in utilizing electricity for agricultural purposes, the question of state aid and the extent to which rural communities are now served by transmission lines, advocates the extension of coöperative methods among farmers to include electric service, and describes some of the manually controlled apparatus used on farms.—*Revue Générale de l'Electricité*, Sept. 7, 1918.

Ignition Magneto Construction.—H. R. VAN DEVENTER.—In this paper the construction of magnetos for both automobile and aeroplane vehicles is discussed. The method of magnetizing as well as the testing of magnetos is also considered.—*Journal of Society of Automotive Engineers*, October, 1918.

Petroleum: A Resource Interpretation.—CHESTER G. GILBERT and JOSEPH E. POGUE.—The bulletin deals with the occurrence, production and refining of petroleum, and also with the problem of ultimate exhaustion.—*Smithsonian Institution*, Bulletin 102, Part 6.

Are There Advantages in Welding Boiler Plate?—HOWARD L. BOYD.—The author points out the dangers of using metal for welding boiler plate which is of a chemical composition different from that of the metal in the plates.—*Power*, Oct. 1, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

NEW RULES GOVERNING ELECTRICAL PRIORITIES

Supplement No. 2 to Circular No. 4 of the Priorities Division of the War Industries Board Gives Rules Affec ing Electrical Products

The Priorities Division of the War Industries Board has issued Supplement No. 2 to Circular No. 4, embodying rules and regulations governing priority in production. Effective as of Oct. 15, Sections 5, 7, 8, 9 and 23 of Circular No. 4 and Supplement No. 1 to Circular No. 4 are repealed and substitutes are provided. The following excerpts affect the electrical industry:

"Section 5. Class C comprises all orders and work not covered by priority certificates issued by the Priorities Committee or not taking an automatic rating in accordance with the provisions of Sections 7, 7-A, 7-B, 8 and 8-A hereof, which orders and work are placed by and are to be utilized in connection with an industry or plant appearing on preference list No. 2, promulgated and published by the Priorities Division under date of Sept. 3, 1918, and all amendments and substitutes therefor, or which orders and work are to be utilized in furtherance of one or more of the following purposes or uses: (a) For the maintenance of existing equipment for the supply of heat, light, power and sanitation; (b) for the necessary supplies and essential repairs (not extensions or replacements) to existing buildings and manufacturing plants."

Section 7-B deals with automatic rating for orders placed by transportation, telephone and telegraph facilities.

Section 8, giving automatic ratings for defined purposes, includes:

For the manufacture of turbines (all classes), A-4.

For the production of electrodes, A-5.

For the manufacture of electric and hand traveling cranes, shipyard cranes, track pile drivers, portable electric hoists, electric monorail hoists, grab buckets, I-beam trolleys and chain blocks, save such as are under construction for the United States Army, the United States Navy or the United States Shipping Board Emergency Fleet Corporation, B-1. Those for or under direct contract with the three government agencies mentioned are A-5.

For the manufacture of electrical equipment (excepting turbines) for the generation, distribution and utilization of electrical energy for power, traction and light, of radio apparatus, of electromedical apparatus, of electric welding apparatus, of electric furnaces, of electric signal and communicating systems and of such electrical supplies only as are essentially required in the installation or use of such electrical equipment or systems, on strict compliance with the provisions of this section and with the provisions of Circular No. 53 issued by the Priorities Division of date Oct. 15, 1918, B-2.

For the manufacture of telephonic and telegraphic instruments and equipment for use in connection with the military program, A-4.

For the manufacture of steam condensers, A-6.

For the manufacture of high-pressure boilers, superheaters and circulating pumps, B-1.

For the manufacture of automatic stokers, B-2.

For repairs to gas, light, water and power plants operated as public utilities, A-5.

PLAN FIFTY MILLION DOLLARS FOR POWER-PLANT RELIEF

Joint Resolution Reported to the United States Senate to Empower War Industries Board to Take Prompt Action

A joint resolution of the Senate and House of Representatives to empower the War Industries Board to expend $50,000,000 for power-plant construction was reported on Oct. 28 in the Senate by Senator Fletcher from the committee on commerce.

The bill provides that for the purpose of securing such increases in electrical or mechanical power as it may deem necessary to carry on the manufacture of war munitions and the construction of ships during the existing war the War Industries Board is authorized and empowered, within the limits of the amounts appropriated and subject to the limitations prescribed, to aid in equipping or expanding any private power plant to such extent as it may deem necessary by making advances to the owner or operator of such plant upon such terms and conditions as may be prescribed by the War Finance Corporation. Such terms may include an agreement that if at a time provided for in the contract, which shall not be later than five years after the termination of the war as proclaimed by the President, it shall appear that the actual reasonable cost of constructing, equipping or expanding such plant shall have exceeded a sum fixed in or to be ascertained by a method prescribed in such contract, repayment of the whole or any part of such excess will be waived. Such contract may provide further for determining the amount of such excess by arbitration or otherwise, provided that no contract for the advance of any such moneys shall be made except under the supervision and with the approval of the War Finance Corporation.

For the purposes of providing the money authorized there is appropriated out of any funds in the treasury not otherwise appropriated $50,000,000.

All authority granted by the provisions of this act shall cease upon the proclamation by the President of the termination of the war, but the termination of such authority shall not affect any contract made, act done or any right or obligation accruing or accrued or any suit or proceeding had or commenced under the terms of this act prior to such termination.

It is understood that this bill is proposed to grant emergency relief pending final action on the larger appropriation of $175,000,000 or $200,000,000.

DR. GARFIELD UPON THE WINTER'S COAL OUTLOOK

Ready for an Unusually Severe Winter, but We Are Still Dependent Upon Public Co-operation in Fuel Conservation, He Says

The fuel outlook for the winter is outlined in a statement by Dr. Harry A. Garfield, United States Fuel Administrator.

"The Fuel Administration approaches the winter season well organized, with stocks of coal on hand far in excess of the stocks of other years," the report says. "We are ready for an unusually severe winter, but we are still and shall continue to be dependent upon the coöperation of the people of the United States in conserving fuel and upon the several agencies concerned in the production and transportation of fuel to enable us to carry through our program to the end of the year.

"The people of the United States have demonstrated their willingness to make any sacrifice necessary, but they must be satisfied that what is asked is necessary and reasonable. The highest testimony to democracy has been furnished by the way in which the people of the United States have met the requests of the Food and Fuel Administrations, even when those requests have imposed upon them personal inconvenience and sacrifice."

Of the bituminous-coal situation Dr. Garfield says in part:

The following schedule tells the story of increased production of soft coal since 1913:

Year	Short Tons	Increase Over Previous Year, Tons
1913	478,435,297	(Decrease)
1914	422,703,970	55,731,327
1915	442,624,426	19,920,456
1916	502,519,682	59,895,256
1917	551,790,563	49,270,881
1918 (estimated)	600,000,000	48,000,000

Increase 1918 over 1913, approximate, 122,000,000.

The enormous increase for the present year has been made possible by cordial coöperation between the three agencies involved, namely, the mine workers and operators, the Railroad Administration and the Fuel Administration. What is our situation to-day? The coal year begins April 1. During the first six months to Oct. 1 we had produced 37,000,000 tons bituminous more than we produced in the corresponding period last year. By produced I mean placed in railroad cars and delivered either as coal or coke.

What the public wishes to know is whether this coal is being distributed in any way to meet the needs of the country and whether we have been far-sighted enough to stock coal against the winter's needs. The important item here is how much coal we have managed to store up. Briefly, the answer is, more than ever before. Taking the country as a whole, we have in stock coal sufficient to last for a period of eight weeks.

Never until the present year has an attempt been made to ascertain the stocks on hand. The Statistical Bureau of the Fuel Administration receives a weekly post-card report from each of the great and most of the small industrial plants and coal dealers of the country. Tens of thousands of small manufacturing establishments are included in the weekly returns of public utilities supplying them with power and light. An average of more than ten thousand cards are received and tabulated daily. Errors and omissions are diligently followed up. Final tabulations of these reports are at the outside only six weeks behind. The following schedule tells the story of requirements for the year, the deliveries for the first six months and the stocks on hand in the several states:

Total estimated requirements of bituminous coal, April 1 to Sept. 30, 1918, without allowance for conservation or curtailment of industry, net tons	361,730,000
Production of bituminous coal, April 1 to Sept. 30, 1918, net tons	312,282,000

NUMBER OF WEEKS' STOCKS OF BITUMINOUS COAL ON HAND OCT. 1 OF INDUSTRIES, PUBLIC UTILITIES AND COAL DEALERS

States	No. of Weeks	States	No. of Weeks
Alabama	2	Nebraska	4
Arkansas	10	Nevada	15
Arizona	4	New Hampshire	18
California	6	New Jersey	10
Colorado	4	New Mexico	4
Connecticut	17	New York	6
Delaware	10	North Carolina	5
Florida	10	North Dakota	11
Georgia	6	Ohio	6
Idaho	5	Oklahoma	9
Illinois	6	Oregon	3
Indiana	5	Pennsylvania	7
Iowa	6	Rhode Island	12
Kansas	5	South Carolina	8
Kentucky	3	South Dakota	7
Louisiana	7	Tennessee	3
Maine	17	Texas	4
Maryland	5	Utah	4
Massachusetts	19	Vermont	15
Michigan (upper peninsula)	20	Virginia	4
Michigan (lower peninsula)	12	Washington	4
Minnesota	20	West Virginia	4
Mississippi	8	Wisconsin	9
Missouri	6	Wyoming	5
Montana	5		

Note.—The upper peninsula of Michigan and the states of Wisconsin and Minnesota and in part North Dakota and South Dakota have their winter supply of coal assured through the movement of coal to the head of the lakes, which is going forward on schedule.

The clean-coal campaign, inaugurated to relieve users of bituminous coal from the handicap they suffered last winter in the use of improperly graded or entirely unprepared coal, is being rigidly prosecuted. During the week ended Oct. 26 thirteen mines were ordered to cease shipping. Prior to that time eighty-six mines had been closed—sixty-seven because the producers would not properly prepare their coal for shipment, and nineteen because the coal produced was entirely unsalable. In addition to these mines closed, several hundred mines have been ordered to cease taking coal from poor veins.

Schwab at Essington

Charles M. Schwab, director of the American shipbuilding activities, hurled verbal "hot shot" at the Kaiser in a recent speech at the Essington Works of the Westinghouse Electric & Manufacturing Company, South Philadelphia. The occasion was the rasing of a flag and the formal dedication of the works and the workmen to the task of making every effort to equip the ships needed to win the war. H. T. Herr, vice-president of the Westinghouse company, introduced Director Schwab.

PLANS MADE FOR RELIEF IN FUEL AND IN POWER

Charles E. Stuart, Now Chief of the Power Section of the Bureau of Production, Outlines Comprehensive Conservation Measures

Charles E. Stuart, who has done much effective work in the conservation of fuel as an official of the United States Fuel Administration, has now been appointed chief of the power section of the Bureau of Production of the Fuel Administration.

Mr. Stuart has sent to production managers of the Fuel Administration throughout the country the outline of a plan for organized relief of acute fuel and power conditions. It is believed that the plan will enable the Fuel Administration to extend a service which will be valuable not only under present conditions, when the power situation throughout the country is in a critical condition, but also when efficiency and economy will be of as great importance as or greater relative importance than to-day.

ACTIVITIES OF THE POWER SECTION

The power section has in the past followed up all reports of power trouble and has done what has been possible to alleviate these troubles. The past activities of the power section in this respect are briefly outlined below:

1. Survey of power conditions where bad service has been reported.
2. Analysis of requests from mines for purchased power and submission of these requests to the Priorities Board of the War Industries Board.
3. Assistance to the central stations serving mines where these stations have been unable to finance through the usual channels. This assistance, of course, has been in the way of indorsement to the War Finance Corporation of the Capital Issues Committee.
4. Assistance where there have been right-of-way difficulties in the running of power lines.
5. Questions of rate relief.
6. Survey with the object of locating independent isolated plants that might be opened up, where power systems have been overloaded.
7. The establishment of a coöperative basis with other administrations at Washington, such as the War Industries Board, War Department, Navy Department and Emergency Fleet Corporation. In this connection a representative of the power section of the Fuel Administration is also a member of the power committee of the War Industries Board.

In certain districts the work has gone farther; for instance, in central Pennsylvania an effort has been made to bring the attention of the operators to those elements which go to make up bad power conditions and which in turn lower production.

It will be the object, Mr. Stuart says, to bring before the production committee of every mine in a simple and graphic manner those elements which have the greatest bearing on coal production from the standpoint of efficient utilization of power as well as of electrically driven machinery and to enlist their study and coöperation.

The central stations in nearly every coal-producing center of the country are overloaded, and eliminating the question of power demand for additional mines, the rate of growth of power demand of mines already in operation is rapidly increasing to a point where the stations in many cases will be unable to carry their load. "We believe that by coöperation along these lines great service can be rendered," Mr. Stuart adds.

The plan for the organization of the work is set forth by Mr. Stuart as follows:

I. Function of Power Section of the Production Bureau at Washington

1. Survey of power conditions as affecting mines. In this connection the following contingencies are faced:

(a) Unless we have the needs of the various coal fields fully in hand and in greater detail than at present we shall be unable to arrange that the needs be promptly and properly cared for when the Sims bill passes. We now have a superficial knowledge of the requirement, but in nothing like the detail that is necessary. Money appropriated by the bill is going to be very rapidly expended.

(b) We have found considerable inertia among certain of the power companies. In cases of existing difficulty in financing and in the obtaining of material this inertia is on the increase. There is a tendency on the part of the power people to throw up their hands and say that we are doing all that can be done. We have found that the presence of our engineers in the field has tended to bring prompt and thorough action from the power companies. We have had a number of comments to this effect from the production managers.

(c) The loads on the different power companies are growing rapidly. The tendency of the power company is to take all load that is offered. In many cases there is no reserve even at the present time. The ordnance and other departments, of course, are looking after their own, and in some localities load is being taken on which sooner or later is going to interfere with service to mines. To provide adequately against such shortage from this angle, we have simply got to know the facts in a way that is only possible through both careful study and careful follow-up.

(d) Emergency Section.—In case of break-down or when power facilities are unequal to demand our engineers should be able to step in at a moment's notice and advise the administration of the situation. We have done this in cases, but only after delay incident to getting men to the ground.

2. Analysis of requests from mines for purchased power and submission of these requests to the Priorities Board of the War Industries Board.

3. Assistance to the central stations serving mines where these stations have been unable to finance through the usual channels. This assistance, of course, has been in the way of indorsement to the War Finance Corporation or the Capital Issues Committee.

4. Assistance where there have been right-of-way difficulties in the running of power lines.

5. Questions of rate relief.

6. Survey with the object of locating independent isolated plants that might be opened up where power systems have been overlooked.

7. The establishment of a coöperative basis with other administrations at Washington, such as the War Industries Board, War Department, Navy Department and Emergency Fleet Corporation. In this connection a representative of the power section of the Fuel Administration is also a member of the power committee of the War Industries Board.

8. To stimulate interest of the operators and mine men in the proper utilization of power, in the maintenance of good power conditions within the mines and in the efficient utilization of electrically driven mine machinery.

9. To supervise power companies' service to the miners of the country in such manner as to see that continuity of service is supplied to mines and that the necessary means to that end are taken.

10. To supervise the power companies in such manner as to prevent their taking on additional loads which will interfere with service to those loads already connected.

II. Proposed Power Committees and Their Duties

In each production district there will be a power committee or committees, composed each preferably of three men. This committee or committees will be appointed by the production manager of each production district. These men shall have the following qualifications: They shall be fundamentally of electrical or mechanical training; preferably they shall be technical men. Every field has groups of mines with particularly high-class power men or electrical engineers. In some of the fields there are general operating men whose training has been primarily of a mechanical or electrical character. The chairman of this committee will be known as the United States Fuel Administration district power engineer. Primarily the function of this committee will be stimulating, through production committees and otherwise, the production in the various mines by the following means:

(1) The maintenance of good power conditions in the mines.

(2) The efficient utilization of all machinery at the mines.

(3) The efficient maintenance of all apparatus in and about the mines, and in case of trouble of any sort to render such relief and advice as is within their power.

(4) To coöperate and advise with the field representatives in all matters.

(5) To distribute information and stimulate the study of efficient application and utilization of power and equipment.

(6) Coöperation with the power section at Washington with respect to other functions indicated.

III. Field Organization and Its Duties

There will be five field engineers. The twenty-eight production districts will be divided among the field engineers. The work of these field engineers will be as follows:

(1) To assist the production managers in organizing their committees.

(2) To keep in close touch with the power committees of the several districts over which they have jurisdiction, keeping them stimulated in their work.

(3) To respond immediately to calls in case of trouble.

(4) To represent the personal contact between the power committees and Washington.

(5) To coöperate with the power committees in the handling of the field work with respect to all functions of the power section.

IV. Duties of Mine Production Committees as Related to Power

These functions will be set forth in bulletin form and in such manner as to be readily comprehended by the production committees. Broadly speaking, however, the function will be to coöperate with the power committees along the following lines:

(1) To assist the production managers in organizing their committees.

(2) To keep in close touch with the power committees of the several districts over which they have jurisdiction, keeping them stimulated in their work.

(3) To respond immediately to calls in case of trouble.

(4) To represent the personal contact between the power committees and Washington.

(5) To coöperate with the power committees in the handling of the field work with respect to all functions of the power section.

The production managers, who are asked for their indorsement, if they approve the plan as submitted, or for constructive criticism, if they see opportunity for improvement, are:

Name	Address	Field
Charles O'Neill	Altoona, Pa.	Central Pennsylvania
F. B. Reimann	301 Butler Co. Bank Bldg., Butler, Pa.	Western Pa. north of Pittsburgh
R. W. Gardiner	Farmers' Bank Bldg., Pittsburgh, Pa.	Pittsburgh and Pan Handle district
James S. Amend	Court House, Greensburg, Pa.	Westmoreland, Irwin Gas, Ligonier, Latrobe, Greensburg
W. L. Byers	Uniontown, Pa.	Connellsville region
H. P. Brydon	Cumberland, Md.	Cumberland, Piedmont and upper Potomac, Md., and W. Va., Somerset-Meyersdale, Pa.
F. M. Lockhart	Somerset, Pa.	Somerset-Meyersdale
Brooks Fleming, Jr.	Fairmont, W. Va.	Fairmont-Clarksburg
J. J. Roby	826 Guardian Bldg., Cleveland, Ohio	Eastern and central Ohio
Wm. H. Wallace	Eddy Bldg., Saginaw, Mich.	Michigan
J. H. Pritchard	515 Outlook Bldg., Columbus, Ohio	Southern Ohio
H. F. Price	Ashland, Ky.	Big Sandy and Elkhorn
A. L. Allais	Hazard, Ky.	Hazard
J. W. Dawson	Charleston, W. Va.	High volatile fields of southern W. Va.
E. E. White	Glenwhite, W. Va.	New River and Winding Gulf
R. D. Patterson	Bluefield, W. Va.	Tug River and Pocahontas field
G. D. Kilgore	Norton, Va.	Clinch Valley and southwest Va.
Howell J. Davis	Holsten Bank Bldg., Knoxville, Tenn.	Harlan field in Kentucky, Tenn., and gas
H. C. Selheimer	Birmingham, Ala.	Alabama
W. G. Duncan	Greenville, Ky.	Western Kentucky
W. J. Freeman	Trust Bldg., Terre Haute, Ind.	Indiana
F. C. Honnold	Fisher Bldg., Chicago, Ill.	Illinois
Ira Clemens	Railway Exchange Bldg., Kansas City, Mo.	Iowa, Missouri, Kansas, Arkansas, Oklahoma, Texas
A. K. Craig	Acme, Wyo.	Montana and northern Wyoming
Thomas Sneddon	Diamondville, Wyo.	Utah and southern Wyo.
J. F. Welborn	Boston Bldg., Denver, Col.	Colorado
Geo. T. Brown	Gallup, N. M.	New Mexico
D. C. Botting	Seattle, Wash.	Washington

Combined Accident and Fire Prevention Code

The Bureau of Standards has prepared as an experiment a combined code to see what could be done in covering both accident prevention and fire prevention in one set of rules. This code is now in a tentative state and has been submitted to members of the electrical committee of the National Fire Protection Association and to a committee of municipal electricians for study and criticism before any publicity is given to the rules.

ACUTE SHORTAGE IN THE PRODUCTION OF BRASS

Reasons Why Electrical Manufacturers Must Find Substitutes—Use of Soldiers in the Naugatuck Valley Brass Mills

B. M. Baruch, chairman of the War Industries Board, authorizes the following:

The United States is face to face with a serious shortage of brass. Radical measures of relief must be undertaken if the actual war needs of this government and its allies are to be met. Production is now running approximately 40 per cent below the demand, and despite the most vigorous pruning of civilian demands, the supply falls short even of the requirements for ordnance.

On Aug. 29, 1918, according to figures compiled by Everett Morss, chief of the non-ferrous tubing section of the War Industries Board, the situation stood thus:

SHEET BRASS	Pounds per Day
Requirements for ordnance, ammunition, etc.	2,220,000
Incidental requirements	1,000,000
Total demands	3,220,000
Actual production	1,800,000
Shortage	1,420,000
ROD BRASS	
Requirements for ordnance, ammunition, etc.	840,000
Incidental requirements	300,000
Total demands	1,140,000
Actual production	1,000,000
Shortage	140,000

Since then, owing to the widespread effect of the influenza epidemic among employees of the brass mills, as elsewhere, the situation has grown materially worse and may, in fact, be said to have reached a crisis.

Three measures of relief, in the opinion of the chief of the non-ferrous tubing section of the War Industries Board, appear to be immediately demanded. They are:

1. For the government to release soldiers from the camps and assign them to the brass mills in sufficient number to make up lost production due to shortage of labor.

2. For the War and Navy Departments to eliminate to the utmost possible extent the use of brass in various accouterments and equipment for the army and navy. Major General Goethals, chief of the division of purchase and supplies of the War Department and a member of the War Industries Board, has already been advised by Mr. Morss that all brass buttons on uniforms must be abolished, as there is not enough of the metal available for this purpose.

3. A more vigorous pruning by the government of its demands for other uses and the employment of sharper restrictions to prevent the various departments from demanding more than their actual needs. Specifications must be revised.

Even if given all the men they could find employment for, it is doubtful, in the opinion of Mr. Morss, whether the mills, owing to lack of machinery and other facilities, could meet the demand as it exists to-day. Private industries have already had their supply of the metal curtailed to the utmost, and most of the further cuts must be made by the government departments themselves.

Last week 1000 soldiers from Camp Devens, Mass., were sent into the mills in the Naugatuck Valley, which includes the brass mills of Bridgeport, Waterbury and Ansonia, Conn., but more will be needed. When the detailed estimates of the situation as of Aug. 29 were made, the rolling mills were short 9600 men, or approximately one-third their labor requirements, and production rate in the mills had been cut down to 15 per cent less than the actual production rate during the six-month period ended June 30, 1918, in spite of the increased demand. The manufacturers frankly admitted they were desperate. With the coming of cooler weather there was for a brief spell a slight improvement in the labor situation, but last month, when the influenza epidemic was raging, between 20 and 40 per cent of the mill employees then on the payrolls were laid off sick.

What the aggregate lost production has been in consequence of this it has been impossible as yet to estimate. Meanwhile the demands for the metal in the war program of the government grow steadily. For example, the requirements of the government and its allies for brass for small-arms ammunition and artillery shells up to 4.7-in. caliber amount of themselves to approximately 2,000,000 lb. a day.

As stated in last week's issue of the ELECTRICAL WORLD, electrical manufacturers are taking steps rapidly to introduce substitutes for brass.

DANGER IS THREATENED TO WATER-POWER LEGISLATION

Prospect of Action by Congress Will Be Lessened, It Is Believed in Washington, if Senator Shields of Tennessee Is Not Re-elected

Students of the water-power situation and friends of the administration in Washington who have at heart the early passage of water-power legislation are earnestly hoping that Senator John K. Shields of Tennessee may be returned to office at the coming elections, Nov. 5. In the Washington circles mentioned it is believed that the prospect of water-power legislation would be hampered if Senator Shields were not returned to office and if, before any bill could be enacted, it became necessary for a successor to make the important studies of water-power legislation he has made.

Senator Shields is confronted with a fight in his own state on his record in regard to water-power legislation, but it is said in Washington that there are the best of reasons for believing that this fight does not extend to all of the people of Tennessee who will be called upon to pass on his candidacy and that many of them do not understand the questions involved in water-power legislation.

Senator Shields is credited in Washington with having sound economic views on the development of the water-power resources of the country. He has had a successful career in the Senate since he went to Washington in 1913 and has served as a member of the important committees on foreign relations, the judiciary, commerce and the Mississippi River. In addition, he is now occupying the important position of chairman of the conference committee of the Senate in charge of water-power legislation.

RECONSTRUCTION COMMISSION BILLS PENDING IN CONGRESS

Contest Threatened in Washington Upon Character of Agency to Guide American Industry in Period After the War

BY WINGROVE BATHON
Washington Representative "Electrical World"

A great fight is about to be staged in Congress, according to the view of well-informed Washingtonians, based upon what character of reconstruction commission or agency shall be intrusted with the work of guiding American industry during the period after the war.

Two important bills have been introduced in Congress dealing with this subject. One bill is fathered by Senator John W. Weeks of Massachusetts, the other by Senator Lee S. Overman of North Carolina. The bill introduced by Senator Weeks, which is in fact a proposed concurrent resolution of Congress, would provide for a congressional committee on reconstruction, to consist of three senators to be named by the Democratic senatorial caucus, three senators to be named by the Republican senatorial conference, three representatives to be named by the House Democratic caucus and three representatives to be named by the Republican House conference.

No provision is made in Senator Weeks' plan for appointing business men in private life on his proposed reconstruction agency. On the other hand, Senator Overman's bill would establish a federal commission on reconstruction, to be composed of five commissioners who would be appointed by the President of the United States. The plan of Senator Overman is known in Washington as the administration plan and is said to have the sanction of President Wilson. Senator Overman's plan also, it is understood, contemplates the appointment by the President, as commissioners, of business men in private life, who shall have the authority to employ and consult economists, investigators, special experts, etc., and the sum of $500,000 is appropriated under the bill to carry out its provisions. In this respect Senator Overman's plan follows the line of suggestions made by the Washington representative of the ELECTRICAL WORLD in these columns last spring.

Both measures specify the character of the investigations to be made—namely, problems affecting labor, capital and credit, public utilities, the results from the demobilization of industrial and military war resources, foreign trade, the condition of existing industries and the establishing of new industries, agriculture, adequate production and effective distribution of coal, gasoline and other fuels; shipping, including shipyards and the sale, continuance of ownership or leasing of yards and ships; housing conditions and the disposition of houses constructed by the government, war legislation now on the statute books, technical education and industrial research, the organization of government departments with a view to putting the government on an economic and efficient peace basis, etc.

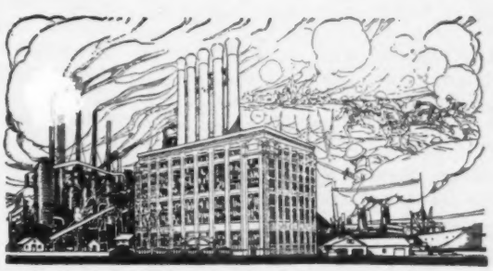
It is pointed out in Washington that Senator Weeks' proposal would place any reconstruction agency formed under his bill in the hands and in control of Congress and that, by reason of the manner in which his proposed reconstruction committee is to be named, it would be difficult, if not impossible, in many cases to have questions decided upon a basis other than their political merits.

Senator Overman's proposal, on the other hand, contemplates the appointment of business men, who might be expected to treat problems coming before them from a business point of view.

The Washington representative of the ELECTRICAL WORLD suggests that because of the radical differences in character between these two proposed reconstruction agencies it would be highly desirable if public hearings were held on the proposed bills, so that the business men of the country might have an opportunity to express their views.

It is suggested that those who take an interest at this time in these bills should write to members of the House and of the Senate urging that hearings be held on the bills before either of them is acted upon in committee.

Conserve Lamps and Energy



Over Here and Over There

Our boys are on their way to Berlin!

At home every instrumentality of our Government and private industry is being urged to speed up to insure speedy, conclusive victory.

Back of the firing line there must be National solidarity, National unity—National *energy*.

Electric Service is in urgent demand because it is the one vitalizing force that is indispensable to the winning of the war.

In home, office, mill, shipyard, shop, factory—on the docks, in the mines, efficient, economical

Electric Service

is toiling, toiling, ceaselessly to further war work.

It is the strong, right arm of labor, the dependence of capital.

Don't waste your Electric Service.

Follow these suggestions of the Fuel Administration, and the War Industries Board, and you will just so surely be helping win the war.

Overhaul your lighting equipment. See that you are not using costly, wasteful, old style carbon lamps. In their place substitute new tungsten lamps, of right wattage to operate on your lighting circuits (see your company).

Turn out lights when you are not using them, do not use two lamps where one will do. The same applies to Electrical appliances. Use them to the utmost to save fuel, food, time and labor, but do not waste current. Turn them off when you are through using them.

Do not use a lamp of excessive candle power when a smaller lamp will give satisfactory service.

For information on the question of conserving, saving Electric Service, phone this company, (insert your number).

(Name of Lighting Company Here)

The Society for Electrical Development, New York, has prepared, at the request of the National Committee on Gas and Electric Service, a number of very effective announcements for use by public utility companies "as another step in the vast program of coöperative construction which the electrical industry is carrying on for the furtherance of war work." These announcements are being sent to every central station in the country.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Residential Extensions During War Time.—Following is an extract from the minutes of a meeting of the District of Columbia Public Utilities Commission: "The commission had before it the request of the Potomac Electric Power Company that it consider the propriety of extending its service mains to residences which are at the present time equipped with and using gas for illuminating purposes. It was held by the commission that, in view of the request of the federal government that all corporations refrain during the war from the use of material and labor where it is not absolutely necessary, an extension of a conduit to a residence already supplied with another form of illuminant is non-essential and the Potomac Electric Power Company is justified in refusing to make any such extensions during the period of the war."

Putting Power Contract on War Basis.—Increased rates were allowed the Sierra & San Francisco Power Company in a decision of the California Railroad Commission, the opinion being written by Commissioner Frank R. Devlin. They represent a part of the increased cost of power to the company, the remaining part being left unprovided for as the utility's share of the burden of war conditions. The schedule of surcharges fixed by the commission follows: Municipal street lighting, 15 per cent of monthly bills; residence and commercial lighting, 1½ cents per kilowatt-hour; power, including heating and cooking, 3 mills per kilowatt-hour; electric railways, 1½ mills per kilowatt-hour; other electric utilities, excepting the Coast Valleys Gas & Electric Company, 1½ mills per kilowatt-hour; Coast Valleys Gas & Electric Company, 2½ mills per kilowatt-hour. At the time of the hearing of the application opposition was made on the part of the United Railroads, the largest consumer, to any disturbance of its charges because of the existence of a contract antedating the jurisdiction of the commission over such matters. To meet this issue, the commission, on its own initiative, made an inquiry into the status of this contract. The United Railroads consumes about 70 per cent of the electrical energy produced by the Sierra company. The opinion states: "The surcharge of 1½ mills per kilowatt-hour applicable to energy sold to electric railways is intended to cover service to the United Railroads with the following reservations, namely, that for the energy supplied by applicant the United Railroads shall pay the Sierra company such additional revenue as will result in an increase of 1½ mills per kilowatt-hour on all energy supplied over and above the revenue that the same quantity of energy would have yielded to applicant under the terms of the United Railroads contract with oil at 66 cents a barrel. . . . Applicant practically owes its existence to the United Railroads contract, which has provided it in past years with a source of revenue that has been sustained through a development period. Under this contract the United Railroads has assumed the burden of stabilizing the Sierra & San Francisco Company and has expressed in the record its willingness to continue its support under present abnormal conditions, reserving, however, any rights which it has under its contract." The Sierra company based its request for increases on the higher cost of labor, fuel oil, insulators and lumber. The surcharges granted are expected, the opinion states, to increase the gross revenue to an amount which will give to the company a surplus of $41,661. "This is a comparatively small margin for surplus," says the opinion. "It is thus evident that the company's consumers will not carry the entire burden of increased costs, but applicant itself will be required to bear a substantial portion thereof and in so doing will suffer an actual loss in earnings with a corresponding reduction in surplus."

Power Rates.—In approving new rates for the Southern Illinois Light & Power Company, Hillsboro, the Illinois Public Utilities Commission criticised its power rates in the past, saying: "The increases of rates which are proposed for power service are very material. It appears from the record that the company in the past has had in effect a heterogeneous schedule of power rates. The company has had in effect fourteen different rates for power service, and several of these rates have been used for billing only one power consumer. The rates charged by the company for power service have been as low as 0.63 cent to certain consumers. Power rates of this character cannot be too strongly condemned, since they are obviously discriminatory and are certain sooner or later to lead to difficulty, and instead of developing the business in accordance with the apparent desire of the utility, they result in driving away legitimate power business, or, if not, they result in the taking of this business at rates which return no profit to the company. Under the conditions existing in this case several of the rates appear to have resulted in an actual loss to the company for every kilowatt-hour sold. Under these conditions the utility can have no complaint if it fails to earn a return upon its entire business until such time as it has placed its business on a businesslike basis. During the past year or two the Southern Illinois Light & Power Company has secured considerably increased revenues from its power consumers by changing the consumers from one rate to another."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 871 of this number.

San Francisco Electrical Development League.—Major George F. Sever, United States Corps of Engineers and special representative of the War Industries Board, spoke on "Electric Power Needs of the Pacific Coast" at the Oct. 16 meeting of the league.

New York State Industrial Safety Congress.—A tentative program has been issued for the New York State Industrial Safety Congress to be held at Syracuse, N. Y., Dec. 2, 3, 4 and 5. Among the speakers to address the opening meeting of Dec. 2 will be William B. Wilson, United States Secretary of Labor, and Charles M. Schwab, Director-General United States Emergency Fleet Corporation. The general topic for discussion on that day will be "Safety of Women in Industry." On Dec. 3 the congress will devote its attention to the general subject "Industrial Good Housekeeping," and papers will be given on "When, What and How to Inspect" and "Maintenance and Repair and Their Relations to Safety." In the afternoon of Dec. 3 the general topic for discussion will be "Safe Practices in the Shop," and one of the papers which should be of interest is "Machinery Layouts and Their Relation to Safety." The headquarters of the congress is to be the Hotel Onondaga.

American Institute of Electrical Engineers.—The 343d meeting of the American Institute of Electrical Engineers will be held Nov. 8, at 8:15 p. m., in the Engineering Societies Building, New York City. The meeting will be held under the auspices of the industrial and domestic power committee. A paper will be presented entitled "The Application of Electric Drive to the Cement Industry," which has been prepared by R. B. Williamson, C. A. Kelsey, A. M. Dudley and R. Weichsel, a sub-committee of the industrial and domestic power committee appointed to compile a typical survey of the application of electric motors to a representative industry, standardizing methods for the selection of motors, which it is hoped will serve as a model for the survey of this phase of other industries. The discussion will be open upon the general subject of the recent large development in the use of electric motors in the enormously increased manufacturing facilities of the country designed to meet war conditions, including the effect of electric drive upon the design of factories and upon the economic problems arising from this rapid development. A large number of engineers have been invited to contribute to the discussion.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Explosion at Memphis, Tenn.—The explosion of a steam pipe early on Monday of this week at the Memphis Gas & Electric Company plant put practically all power service out of commission for the day. The company completed repairs and light was turned on at 10 p. m.

St. Lawrence River Power Project.—The New York & Ontario Power Company has asked the International Joint Commission to approve plans to construct a dam across the Little River on the south branch of the St. Lawrence River at Ogden Island. The Dominion government will oppose the application made by the New York & Ontario Power Company.

Great Business Convention on Reconstruction.—The war service executive committee of the Chamber of Commerce of the United States has announced plans for a convention at Atlantic City on Dec. 4, 5 and 6 of the more than 300 industrial war service committees. Problems of war emergency and reconstruction will be discussed. National councilors of the chamber, representing the more than 1100 commercial and industrial organizations which make up its membership, will meet at the same time and place.

Reconstruction of California Lines.—The Sierra & San Francisco Power Company has applied to the California Railroad Commission for an order extending the time in which it shall reconstruct its overhead lines in order to comply with the law of safety in reference to telephone and other electric lines. The applicant says that its service to the public has been so important that it is felt that the service should not be interrupted to make these changes at this time. A similar application has been made by the Coast Valleys Gas & Electric Company for similar reasons.

Spokane Competitors Agree on Rates.—The Washington Water Power Company and the Spokane Heat, Light & Power Company have filed a new schedule of rates with the State Public Service Commission, asking for a restoration of the minimum rate of $1 for residential users of electric light and power, an advance from 70 cents, effective on Nov. 10. The rates were filed by both companies in accordance with an order of the commission that the two companies get together and file uniform rates to avoid price cutting. The present rate of 7 cents for the first 20 kw.-hr. and 3 cents for the subsequent hours are not changed. The minimum of $1 means that instead of using 10 kw.-hr. and paying 70 cents, a consumer must pay for 14 kw.-hr. or he may use 15 kw.-hr. at a cost of $1.05. The wholesale light and power rates are the same, with the exception of a change in discounts which makes an increase of $25 on a bill of $400. It is said this affects only about twelve consumers.

Mid-Day Closing Discountenanced by New England Fuel Administration.—James J. Storrow, New England Fuel Administrator, has issued a statement condemning the proposed noonday closing plan which has been under considerable discussion at Boston, Mass. Closing of stores throughout Massachusetts between 12 noon and 1 p. m. has been advocated by some department-store managers, with the idea that both fuel and labor would be saved thereby. Mr. Storrow points out that this appears to be misapprehension, saying: "It may be a labor conservation measure, but in my judgment it will lead to the consumption of more fuel and not less. To take an hour off the store schedule at high noon, when the minimum of electric light is needed, will not save as much as if the hours were shortened, as was done last winter and may be necessary next winter."

Engineers Needed for Construction Work.—The construction division of the army is believed in Washington to be the largest organization of its kind in the history of the world. The approximate value of construction projects undertaken by this branch of the government since the United States entered the war is $1,000,000,000. The figures representing the material used and the men employed are staggering; 250,000 workmen have been under the control of the division at one time. Among the division's present urgent needs are fifty chiefs of survey party at $2,700 to $3,000 a year; fifty transitmen at $2,400 a year; twenty-five levelmen at $2,100 a year; 125 rodmen at $1,800 a year; 150 chainmen at $1,800 a year, and fifty topographic draftsmen at $2,100 a year. These positions are open to men only, except the drafting positions, which are open to both men and women. All of the positions are in the civil, not the military, service. Persons interested should apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the local board of civil service examiners at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle or San Francisco. Applicants will not be required to undergo a written examination, the examination being of the "non-assembled" type; that is, the ratings will be based upon education, training, experience and physical ability as shown by the applications and corroborative evidence. These positions offer an excellent opportunity for patriotic service, and the Civil Service Commission urges qualified persons to apply for appointment without delay.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Liability of Utility Regarding Private Line.—A public utility corporation furnishing energy for electric lights to an individual user who constructs, owns and maintains a connecting private line and all attached equipment, wholly free from the control or inspection of the corporation, cannot be held responsible for damages on account of deterioration of his private line, and consequent defects therein, resulting in injury to a trespasser who comes in contact with it on private premises, not even adjacent to any path in general use by the public, when the private line was not only properly constructed originally but safely connected with the line of the company generating the electricity, and there was no knowledge on the part of the company as to any subsequent deterioration of the private line, the Court of Appeals of Georgia held in Scott versus Rome Railway & Light Company (196 S. E. 569).

Remedy for Entry of Utility Without Consent.—A public service corporation, in order to acquire an indefeasible title to its easements or other property against the claims of all persons interested therein, should proceed in the manner prescribed by law, making all persons having a present or prospective interest therein parties to a condemnation or other proceeding by which they will be bound, the Supreme Court of South Carolina held (96 S. E. 725). A corporation having power to condemn lands for a public purpose which takes possession of land for such purpose without express or implied consent of owner becomes a trespasser. Where a corporation having power to condemn land for public purposes takes possession of land for such purpose without consent of owner, the corporation, although liable as trespasser, cannot be ejected as ordinary trespasser and may retain possession. Where a corporation having power to condemn land enters upon land without owner's consent, the amount to which owner is entitled upon corporation's remaining in possession of land is to be ascertained by statutory method of determining compensation for condemnation where compensation is not denied, and by a jury in an action in the Court of Common Pleas when compensation has been denied but case adjudicated in owner's favor. Where the owner of legal title or of an estate in less than the fee is in possession of land at the time it is taken for public use, such owner is bound by the statute under which the land is taken and must apply for compensation in the manner and within the time therein prescribed.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. E. Cox, superintendent of the steam-heating department of the Birmingham (Ala.) Railway, Light & Power Company, has resigned to enter the service of the Birmingham Steel Company.

Frederick G. Simpson, vice-president and general manager of the Kilbourne & Clark Manufacturing Company, Seattle, maker of wireless apparatus, has been called into active service and assigned to engineering duties with the rank of lieutenant commander, United States Naval Reserve.

John T. Mountain, assistant to the chief operating engineer of the Commonwealth Edison Company of Chicago, has been commissioned a captain in the combatant branch of the Engineer Corps of the United States Army. He has entered upon a course of training at Camp Humphreys, Va.

L. H. Kistler, for the last five years electrical engineer of the Northern California Power Company at Redding, Cal., has resigned to enter an officers' training camp at Washington, D. C. Mr. Kistler was tendered a banquet by officials of the company on the evening preceding his departure.

C. Nesbit Duffy has resigned as vice-president of the Manila (P. I.) Electric Railroad & Light Company to accept the position of vice-president of the Visayan Refining Company, Manila, P. I., one of the largest cocoanut-oil companies in the Philippine Islands Mr. Duffy is to take over his new duties on Nov. I.

Arthur F. Allsop, electrical heating engineer for the Commonwealth Edison Company, Chicago, has accepted an appointment with the United States Army, Ordnance Department, as a chief army inspector of ordnance. Mr. Allsop had been in the employ of the Commonwealth Edison Company for seven years.

J. C. Rockwell, the present general manager of the Manila (P. I.) Electric Railroad & Light Company, following the resignation of C. N. Duffy as vice-president, is being placed in full charge of the affairs of that company in Manila by the J. G. White Management Corporation, New York, the operating manager of the property.

M. O. DellPlain has been transferred from the Syracuse (N. Y.) Lighting Company, where he was sales manager, to the Northern Indiana Gas & Electric Company, Hammond, Ind., where he has taken up the duties of vice-president and general manager. Both of these properties are operated by the United Gas Improvement Company.

L. J. Hirt, vice-president of the Pearson Engineering Corporation, has resigned from the United Gas & Electric Engineering Corporation as chief engineer, which position he has held for about a year and a half, owing to the pressure of his duties with the Pearson interests. Mr. Hirt has been connected with the Pearson Engineering Corporation since 1889.

C. S. Ruffner, vice-president and general manager of the Union Electric Light & Power Company, St. Louis, Mo., and a member of the board of managers of the American Institute of Electrical Engineers, who underwent an operation for appendicitis the latter part of August, is being welcomed by his friends and associates upon his recovery and return to his duties.

Frank H. Brooks, formerly manager of the Lincoln (Neb.) Traction Company, member of the firm of Mid-West Electric Company of Omaha, Neb., and general manager of several Iowa public utilities, has recently been appointed general manager in charge of operation of the Continental Gas & Electric Corporation's properties in Iowa and Nebraska, with headquarters at Omaha, Neb.

James B. Harvey, who for a number of years has been general manager of the Public Service Company, York, Neb., has recently been elected vice-president of the Continental Gas & Electric Corporation and placed in active charge of the company's properties in Iowa and Nebraska, with headquarters in Omaha, Neb. Mr. Harvey is a graduate of the University of Nebraska and has for a number of years taken an active part in the growth of the electric lighting, railway and transmission industries of that State.

A. C. King, formerly engaged in consulting engineering practice in Chicago, has been commissioned as major in the Quartermaster's Corps in charge of the electrical section of the construction division. Prior to taking up consulting engineering in the spring of 1916, Mr. King was for three years deputy commissioner of gas and electricity for the city of Chicago. He was graduated from the University of Wisconsin in 1901 and immediately afterward became connected with the Northern Electric Company at Madison, Wis. There he rose to the position of assistant chief engineer, resigning in 1907, when the company was taken over by the General Electric Company, from which time until 1911 he was engaged in consulting engineering work. He later became associated with Ray Palmer, who at that time was engaged in making an electrolysis survey of the city of Chicago. During the period as deputy commissioner he was in charge of the city's investigations of the rates of the Commonwealth Edison Company, the city's valuation of the Automatic Telephone Company and of a valuation and report on electric and gas rates in the city of Cincinnati.

E. N. Hyde has resigned as general supplies sales manager of the Northern Electric Company of Montreal, Canada, and is returning to Philadelphia, where after a short rest he expects to go into business. Prior to going to Canada Mr. Hyde was associated with the Frank H. Stewart Electric Company. Mr. Hyde has been very prominent in the jobbing branch of the industry for many years, and his many friends will be glad to know of his return to the States. While in Canada Mr. Hyde did much to advance the standard of electric lighting.

A. R. Fairchild, electrical and mechanical engineer with the Electric Bond & Share Company, New York City, resigned Oct. 1 with the intention, it is understood, of going into consulting engineering work in New York City. Mr. Fairchild was graduated in electrical engineering from the University of Minnesota in 1907. For six years he was engaged in transmission-line and power-plant design and construction in the West. He then became electrical engineer in charge of work for W. V. N. Powelson, consulting engineer, New York, and in 1914 went to St. Louis, Mo., where he was assistant electrical engineer with the Union Electric Light & Power Company. In 1916 he resigned to become superintendent of distribution and construction for the Light & Development Company, St. Louis, and in the following year went to Bluefield, W. Va., as assistant superintendent of the engineering and construction department of the Appalachian Power Company. Later he went to New York with the Electric Bond & Share Company, where he was engaged until he resigned, designing and purchasing for construction of high-tension work.

Donald McNicol, during the past nine years assistant engineer of the Postal Telegraph-Cable Company, New York, and well known as an author and writer, on Oct. 21 assumed the editorial management of the *Telegraph and Telephone Age*, to fill the position made vacant by the death of Thomas R. Taltavall. Mr. McNicol has been intimately identified with the telegraph, telephone and railroad interests in the United States for the past twenty-two years. He began his career as a telegrapher in Canada and has had a wide experience in all branches of the service. He has been a copious writer and he brings to the *Telegraph and Telephone Age* valuable experience which will find abundant opportunity for application in his new position. He is a fellow of the American Institute of Electrical Engineers and takes an active part in its deliberations, now serving as chairman of the Institute's committee on telegraphy and telephony. Besides, he is a member of the Institute of Radio Engineers and of the Telephone Pioneers of America, and for many years has kept in close touch with the many phases of telegraph, telephone and radio development in foreign countries as well as America.

John F. Wessel, who about a year and a half ago was elected vice-president of the United Gas & Electric Engineering Corporation, has just been appointed chief engineer of the corporation in addition, succeeding L. J. Hirt, who has resigned. Mr. Wessel is a graduate of the Massachusetts Institute of Technology and for many years has been identified with lighting and railway interests. He was general manager of the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio, prior to coming to New York toward the end of 1913.

John R. Anderson, chief engineer of the Milwaukee Electric Railway & Light Company for the last six years, will become a consulting engineer for the naval overseas transportation service in New York. Secretary of the Navy Daniels offered Mr. Anderson the rank of lieutenant-commander in the navy as he had been a naval volunteer during the Spanish-American War. This offer, however, was refused, since Mr. Anderson believes he can do better work as a civilian. His appointment is for the duration of the war, but he will not sever his connection with the Milwaukee Electric Railway & Light Company definitely. He is retained in supervisory control of the company's engineering work.

Obituary

Allan C. Choate, purchasing agent of the Eastern Pennsylvania Railways Company, died of pneumonia on Oct. 13, in Pottsville, Pa. He was a son of Joseph K. Choate, vice-president of the J. G. White Management Corporation, New York, N. Y.

William Allis, chairman of the board of directors of the Allis-Chalmers Company, Milwaukee, Wis., died on Oct. 10, at the age of sixty-nine years. Mr. Allis succeeded his father, the late E. P. Allis, as president of the E. P. Allis Company and continued in that position until the consolidation which resulted in the Allis-Chalmers Company, of which he became chairman of the board.

Frank I. Parker of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., died at his home in Milwaukee on Oct. 18, at the age of thirty-six years. His death was due to pneumonia following Spanish influenza. Mr. Parker was graduated from the University of Wisconsin in June, 1906, and in July became engineer in charge of production in the magnet and clutch department of the Cutler-Hammer company. His early work was with lifting magnets made by this company, and he was responsible for many of the features of these magnets as well as for the design of several of the company's magnet and motor-operated brakes. After 1911 Mr. Parker had charge of the sales service work on the clutch department products. He was a member of the American Institute of Electrical Engineers.

H. L. Gannett, who died a short time ago, was for years the inspector of safety and fire prevention for the Commonwealth Edison Company of Chicago. Mr. Gannett was with the Commonwealth company and its predecessor company for thirty-two years. He started as a repair man and advanced to the position of repair foreman and assistant superintendent of construction and in 1894 was placed in charge of the repair department. After the company first began organizing safety work he devoted most of his time to it and achieved such success that in 1914 the company was awarded a gold medal by the American Museum of Safety for the work it had done in safeguarding its employees. Mr. Gannett was active in the Chicago Safety Council, of which he was president during the years 1916 and 1917.

Lieut. Charles R. Seed, U. S. N. R., superintendent of power, Worcester (Mass.) Electric Light Company, died recently at Worcester from pneumonia. Lieutenant Seed was widely known and liked among central-station circles in New England. He was born at Lawrence, Mass., forty-three years ago, and after a course in engineering on the Massachusetts nautical training schoolship Enterprise he spent seven years as an engineer in transatlantic service. He then was employed as a stationary engineer in industrial concerns at Utica, N. Y., and Blackstone, Mass., afterward going to Portsmouth, N. H., as chief engineer of the Rockingham County Light & Power Company. In 1911 he became chief engineer of the Webster Street plant of the Worcester company and soon was made superintendent of power. During the Spanish-American War he served as junior engineer aboard the U. S. S. St. Louis. When war was declared by the United States against Germany he immediately offered his services and was soon ordered to report at the Boston Navy Yard, having been commissioned as ensign. The Worcester company gave him a leave of absence for the period of the war and had hoped to have him resume his former post at its close. After serving for a short time along the coast of France, he was promoted to lieutenant and was on patrol duty for nearly a year. In June, 1918, Lieutenant Seed returned to the United States and was assigned for duty in the Fore River shipyards at Quincy, Mass.

Willard E. Case, widely known as a student of electrical science, particularly electrochemistry, died at Auburn, N. Y., on Oct. 27 from Spanish influenza. Mr. Case was born in Auburn on Feb. 19, 1857, and on his mother's side was descended from John Fitch, a pioneer in steam navigation. Mr. Case studied in public schools and under private tutors and subsequently was graduated from Hamilton College Law School. His tastes, however, ran more to science than to the law, and in 1886, when but twenty-nine years old, he read a paper before the Royal Society of London on "A New Means of Converting Heat Energy into Electrical Energy," which brought him into prominence. In 1897 he read a valuable paper before the New York Electrical Society on "Electricity from Carbon Without Heat." His laboratories at Auburn, among the finest in the country, are now being used by a force of electrochemists in government work. Mr. Case had been especially interested in the conservation of the power of the sun rays and the transmission of black-and-white photography by wire. He was a member of many scientific organizations, including the Faraday Society and Royal Arts Society of London, the American Electrochemical Society, the American Institute of Electrical Engineers and the New York Electrical Society. He was particularly interested in the latter organization and in October of last year made what was said to have been the largest endowment in years to the New York Electrical Society, to be known as the Case Fund.

William Main, formerly professor of chemistry in the University of South Carolina and one of the pioneers of the electrical industry, died at his home in Piermont, N. Y., on Oct. 18 in his seventy-fourth year. He was graduated from the University of Pennsylvania and later from the Polytechnic College of Pennsylvania. His earlier years were devoted to the mining industry. Later Professor Main turned his attention to electricity and invented and developed the high-voltage lead-zinc storage battery. As inventor and engineer of the River & Rail Electric Company he applied the storage battery to the propulsion of cars and boats and developed the batteries, motors, transmission gearing and control apparatus of the street cars built by that company. He was also at one time connected with the Consolidated Electric Light Company, and as its superintendent and engineer was particularly interested in standardizing the methods of lamp-filament manufacture and treatment and the methods of bulb exhaustion. For many years he had resided in or near New York City and had acted as a consulting engineer and chemist. His sound knowledge and power of clear expression caused him to be frequently called as an expert in litigations, and he was connected with many historical cases, including the protracted litigation over the Tesla polyphase motor patents, the insulated cable cases and the tungsten-filament lamp case. A veteran artillerist of the Civil War, he had devoted his time since the entry of the United States into the present war to the problem of accurate sighting of anti-submarine guns for aeroplanes and to chemical problems growing out of the war. He was a charter member of the American Society of Mechanical Engineers and of the American Electrochemical Society, and a member of the American Chemical Society, the Society of Chemical Industry of Great Britain and various other scientific and literary bodies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

HOW PRIORITIES ARE WORKING ON CONDUIT

Suggestions Made by Prominent Manufacturing Concern to Its Distributers Outline Condition Under Which Supplies Can Be Obtained

Priority regulations are causing no end of trouble both to manufacturers and the trade. Jobbers are especially confused when they find that, although they have a preference rating, still they are not able to get material for stock in many lines. Especially is this true of conduit, and in order to clear up questions which seem to be in the minds of some of its distributers, the American Conduit Manufacturing Company, New Kensington, Pa., has made the following suggestions to its jobbers:

"1. Make a careful study of Circular No. 23, Priorities Division, War Industries Board, addressed to all electrical manufacturers and resale distributers of electrical equipment, apparatus, appliances and supplies. The pledge given in this circular and the conditions recited supersede the pledge and the various conditions which we have previously submitted to you.

"2. When the conditions of Circular No. 23 have been complied with, electrical jobbers are automatically rated B-4, which means that the manufacturers are free to ship to jobbers' stocks, provided that they can do so without interfering with orders taking a higher priority rating, such as A orders or B-1 and B-2 orders.

"3. We have a large tonnage of orders on our books at the present time which are regularly established as being of a higher priority than B-4.

"4. So long as this condition continues jobbers' stock orders will not be reached. However, if your orders are for direct shipment to essential work and supported by affidavit of the user or the indorsement of a government officer, in accordance with the provisions of Circular No. 4, Priorities Division, War Industries Board, they will be given the attention warranted by their relative importance.

"5. In order for us to maintain our standing with the War Industries Board it is necessary for us to call upon you each month for a report showing the disposition of conduit from your stock and under the present conditions. These reports should show a very high percentage of class A business. Certainly, in our opinion, very little, if any, class C business should be shown. At times it will be possible to make limited stock shipments, but the jobber who gets the shipment will be the one whose report shows that he is serving class A."

INSULATING FABRICS AND MATERIALS RAPIDLY ADVANCING

Raw Materials Scarce Owing Largely to Difficulty in Obtaining Supplies from Foreign Countries —War Demand Has Increased

Insulating materials of nearly every kind have in the past year advanced in price from 10 to 50 per cent and in some few cases are now nearly impossible to obtain. Raw materials, coupled with the high price of labor, have been the chief factors in the higher prices. Tremendous government orders for immediate war needs have swept the market nearly bare of stocks. Outside of government needs deliveries in nearly all instances are slow, ranging from two weeks to an extreme of six months in some cases. The following is a list of the more important materials used and the market condition:

Cotton sleeving (pure) is almost impossible to obtain, and deliveries are six months behind. Cotton tape can be had in standard sizes only, ½ in. to 2 in. Deliveries are two months behind, and the price has advanced 50 per cent in the past year. Paints and varnishes for insulating purposes are very short in supply owing to lack of gums. The price has advanced about 50 per cent in the past three months.

The market in friction tapes is very tight on account of the scarcity of cotton sheeting. There are no supplies on hand and the price has advanced 10 per cent in the past four months. The fiber-board situation is stationary and deliveries are slow. Linen cord is practically out of the market. Prices have advanced 50 per cent in the last four months. There is practically no pure flax to be had, and prices have gone 50 per cent higher in the last four months.

Supplies of imported mica on hand are limited, and the demand is good. Prices are variable. Supplies of cut electric mica are plentiful, with no recent price change. The demand for mica products is excellent, but the supplies are low and deliveries poor. Asbestos tape is practically out of the market. Asbestos paper is rapidly taking the place of asbestos tape, and it is stated will probably supersede it altogether.

Varnished-tubing demand is good, and supplies on hand are fair. Prices have not advanced recently. The demand for varnished cambric is great, and supplies on hand for immediate delivery are scarce. Export demand is increasing. Prices have not changed recently. On account of the scarcity of raw silk, supplies of varnished silk on hand are low. The demand is very brisk and prices have not changed since July. Supplies of varnished paper are plentiful, and it is in good demand.

High-melting-point waxes are out of the market entirely. Low-melting-point waxes are in plentiful supply.

MANUFACTURERS IN STRATEGIC POSITION TO MEET PEACE

Electrical Industry in Readiness to Return to Production to Meet Commercial Demand When War Orders Shall Cease

While many industries on the conclusion of peace will be greatly handicapped in getting back again into stride in their normal production, it is gratifying to see the ease with which the electrical manufacturing industry generally will be able to take up commercial demands immediately government demands shall stop.

In a great many lines, and especially those having little or no direct war value, whole plants, including labor and equipment, have been turned over to making products absolutely foreign to their normal production. Guns, rifles, shells, gas masks and other war requisites are being made in quantities in plants formerly turning out commercial materials of a far different nature.

The government has urged the concerns making less essential products to produce munitions of one kind or another. In fact, it is the only way in which a good many plants could continue to operate. Furthermore, when the war broke out in 1914 some plants began to contract to supply munitions to Great Britain, Russia and France in order to keep their plants going. Since that time

business conditions have changed, but some manufacturers found it easier to continue in this work than to change back to their normal output.

In all of this work there will be found certain electrical manufacturing plants. Some have been doing it for three years, others only a few months as they realized the necessity for continuing in a very curtailed production of commercial merchandise. There was a time when electrical manufacturers were well represented in the list of makers of munitions. Generally speaking, however, electrical manufacturers are working at capacity on their normal product, except that it is for war work. Turbine manufacturers are rushed to fill the shipbuilding program. Motor manufacturers for a long time have not been able fully to supply the essential demand. Battery manufacturers are likewise filled up with war orders for batteries. Wire manufacturers have more government orders for wire than can be turned out in the desired time.

It would be possible to continue the list with still other branches of the industry which are wholly engaged in turning out their normal product for use in war work of one kind and another.

The natural result is that as soon as the war demand ceases and commercial demand begins the electrical industry for the most part will be in a position to turn out the goods without having to make extensive alterations in equipment or retrain an army of employees.

Indications are that when peace is restored the demand for electrical products will be of considerable proportions. Low stocks, unessential work and the reduction in building have held off a lot of business that apparently will be quick to be placed when goods can be had.

METAL MARKET SITUATION

Announcement that Present Price of Copper Is to Continue for Remainder of Current Year

The price-fixing committee of the War Industries Board has agreed by telegraph, instead of by conference, with the copper producers to continue the price of copper at 26 cents for the months of November and December. The market is very quiet with no new features. The influenza epidemic is affecting the output of both smelters and refineries, and it is estimated that it is reducing the current output of copper about 20 per cent.

Effective Oct. 20, all outstanding licenses for the importation by ocean shipment of pig tin, tin ore and tin concentrates, or any chemical extracted therefrom, have been revoked. Hereafter no licenses will be issued for the importation of these commodities except to cover shipments consigned to the United Steel Products Company, which is handling the tin situation in the United States.

NEW YORK METAL MARKET PRICES

	Oct. 22	Oct. 29
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.75	28.75
Lead, trust price	8.05	8.05
Antimony	13.37½	12.75
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.20	9.10
Tin, Chinese *	No quotations	77.00 to 77.50
Aluminum, 98 to 99 per cent	Govt. price †33.10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.00 to 23.50	23.00 to 23.50
Brass, heavy	13.50 to 14.00	13.50 to 14.00
Brass, light	11.00 to 11.25	11.00 to 11.25
Lead, heavy	7.50 to 7.75	7.50 to 7.75
Zinc, old scrap	6.00 to 6.25	6.25 to 6.50

* No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb.; 0-ton to 14-ton lots, 33 20 cents per lb.

THE WEEK
IN TRADE

CONDITIONS are apparently the same as they have been. Some local stocks have been momentarily repaired by shipments of orders long overdue. Shortages in other lines than those spoken of last week are showing up everywhere, the most significant being that in heater cord. Unless this situation is bettered shortly some local distributers may find it difficult to dispose of heating appliances.

Prices are still very steady. It is now almost seven weeks since prices advanced with any regularity.

The influenza epidemic is apparently rapidly coming under the control of the health authorities. The full effect, however, should be felt some weeks later, when the decrease in output will serve to prevent diminished stocks from being replenished as much as they might otherwise have been. The output of brass, for instance, fell off, it is estimated by good authority, 35 per cent during the epidemic. Copper output was reduced some 20 per cent. Such things will not necessarily be felt by the industry as a whole immediately, but the inevitable result will be longer deliveries.

NEW YORK

Reports from all branches of the electrical trade in the past week indicate that business is showing no reduction. Demand in almost all lines is heavy, and the manufacturers are forced to the limit to fill present and future orders on hand. The Spanish influenza is still a very serious factor, and working forces are cut down all the way from 20 to 60 per cent, while total shut-downs are not at all uncommon.

Stocks on hand in nearly all lines are exceedingly low and some products are next to impossible to get. Prices during the past week have practically remained stationary, and the early peace talk during the first weeks of the month has apparently in no way had any effect on business either with the manufacturer or the jobber.

LAMPS.—The demand is increasing and the market is in fair shape as to supplies and shipments.

LINE TOOLS.—Announcement was made this week that, effective Sept. 15, climbers' and linemen's tools advanced about 10 per cent. The advance also includes tool bags, digging bars and cable reels. Supplies on hand are only fair and the demand much heavier.

WASHING MACHINES.—These products are still showing marked popularity and the output cannot keep up with the sales. One of the largest manufacturers is eliminating some of the more expensive machines and is prepared to supply three or four of the household sizes only. Prices have not changed recently and stocks on hand are low.

FUSES.—The demand for fuses continues to be very heavy. As far as can be learned the supply of stocks on hand is only fair.

CABLE APPLIANCES.—Stocks on hand of all cable appliances are good and shipments prompt. There have been no price changes reported since June.

HEATER CORD.—A very serious situation is present in the heater cord market. Manufacturers have been called upon to turn their machinery to other more warlike purposes, and there is practically no heater cord in the market. One large appliance-manufacturing concern has sent out a notice to his customers asking that every effort be made to conserve old cord wherever possible and saying that it cannot supply more than six complete cords to any one customer.

FARM-LIGHTING PLANTS.—The Main Electris Manufacturing Company, Pittsburgh, Pa., has advanced the

price of its product, effective Nov. 1. The size formerly at $125 is now listed at $140.

MOTORS.—Motors of all sizes are still in great demand. Stocks on hand are very low and shipments behind. It is practically necessary to have a priority order before a motor of some sizes can be obtained.

CIRCUIT BREAKERS.—Oil-switch and circuit-breaker business is very brisk. Supplies on hand are limited and shipments slow. Prices have not changed recently.

LINE MATERIAL.—Business is very quiet. Stocks on hand are good and shipments prompt. No recent price changes have taken place.

BOSTON

Business continues good, although somewhat below the level of a few weeks ago in volume. Stocks are running lower, but war needs are still being met with efficiency in most lines. Prices show little change, with the exception of an advance of 20 per cent in alkaline batteries, effective Oct. 16. Collections are still running a bit slow. The influenza epidemic appears to be subsiding rapidly in this district, and factory and mercantile operations are being resumed on the former scale. The labor market is seething with unrest. The United States Housing Corporation has filed plans with the inspector of buildings at Quincy, Mass., for the construction of 254 houses, to cost $1,277,500, for shipyard workers.

Deliveries are running about the same as last week. The market is short of electric radiators and washers, and dealers in appliances are in an uncertain frame of mind regarding future business. The announcement of the War Industries Board that the 1919 fan production will be curtailed to 40 per cent of the 1918 figures and that only 75 per cent of this year's vacuum cleaner production will be allowed next year is causing speculation as to the size of stocks which should be carried into the coming year and the extent to which such devices should be locally advertised. The movement to close mercantile establishments during the hours of 12 to 1 as a labor conservation measure is not being favorably received hereabouts, as yet.

MOTORS.—Stocks are fairly good except in the larger sizes. Prices show little change. The demand is somewhat below that of a year ago at this time. Some difficulty is reported in obtaining motors promptly for industrial electric truck applications. Cutting down of production because of the epidemic and labor troubles is the primary cause of a shortage.

CIRCUIT BREAKERS.—Business is very brisk, with 98 per cent government or allied war-plant demand in representative cases. Prices have remained steady since July. The employment of women in factories is increasing and with good results. No accumulation of factory stocks is possible now on any large scale. Raw material is in fairly good supply, when the demand is backed by the necessary priorities.

LAMPS.—The factories are very busy and output is promptly absorbed. Reserve stocks may be said to be in pretty fair shape.

WIRE.—The shortage of No. 14 wire continues, but it is possible to obtain it in reasonable quantities for essential work. While stocks are low, one Boston jobber is known to have 500,000 ft. held for genuine government or related demands. Strict pledging is insisted upon in the moving of such stocks by gilt-edged houses.

ELECTRIC RANGES.—One Boston jobber received a carload of ranges a few days since, but the market is dull, and little pushing of this business can be seen at this time.

INDUSTRIAL ELECTRIC TRUCKS.—Government and related business rules the situation. Close watch is being exercised over the destination of all materials used in truck applications. Prices will show an advance of about $100 on quotations in the immediate future where a recent battery price increase affects bids. Deliveries range now from about two weeks upward, depending on the type of truck ordered. Some difficulty in obtaining motors is reported temporarily.

FIRE ALARM TELEGRAPH EQUIPMENT.—Business is very active in supplying governmental and industrial plants with improved protection apparatus. An order of 1000 pen registers has recently been placed for overseas military service. Municipal business is dull, but ought to be better in view of the importance of better protection and the favorable attitude of the government toward fire-alarm signal apparatus sales and applications. There is a feeling in manufacturing circles that too many municipalities are conducting a short-sighted policy this year in withholding expenditures for fire-alarm apparatus which are justified by the increased risks existing. In spite of the fact that manufacturing costs have increased in many cases from 100 to 300 per cent, the increase in price of apparatus has not been over 20 per cent in standard equipment. Labor conditions are reasonably steady now and the companies are in good shape to handle orders.

STREET-LIGHTING EQUIPMENT.—Municipal business is quiet, but cantonment and housing territory demands are very active.

CHICAGO

The business of the week has been especially brisk, in spite of the continued inroads on labor which are made by Spanish influenza. One electrical manufacturer employing more than 1000 persons reported 19 per cent of them absent on Wednesday. Government contracts and group residential building are again in evidence. Plans have been made by Harry J. Kusel & Company for constructing in Chicago eighty bungalows to cost $400,000. There have been few changes in commodity or product prices.

COPPER WIRE.—The situation in small sizes is not so difficult as was expected by the jobbers. It appears that the severe tightening which occurred a few weeks ago has been somewhat reduced now that the government is supplying wire mills with larger quantities of raw copper. Some shipments of smaller sizes were received this week.

ELECTRIC RANGES.—The manufacturers have stocks of many styles of ranges in Chicago and can accept orders for a considerable number. All of these styles will be offered for sale until present stocks are depleted.

SECOND-HAND MACHINERY.—Purchasers of second-hand machines apparently do not yet understand how to do business under the pledge system. This fact has caused a slowing up in orders for the smaller classes of machines. This does not mean that business is bad, however, for there is still plenty of business in large machines and some concerns have orders for two months ahead on their books. The volume of repair work is the greatest ever known.

TELEPHONE SUPPLIES.—Prices on bridle rings and similar small items have been increased slightly.

ELECTRIC HEATERS.—Household-type air heaters are in brisk demand with the supply limited. One manufacturer is refusing orders. Another manufacturer expects to put a new stock on the market next week.

MOTORS.—Manufacturers are still loaded to the limit with orders. Nevertheless, enough time is being spared here and there to get out new bulletins in foreign languages for use on present and future export trade.

METERS.—With the future of the farm-lighting plant in the hands of the War Industries Board, meter manufacturers who have been making both low-voltage and industrial-plant equipment are making special efforts to get ready to switch to the latter line exclusively if necessary.

HOUSEHOLD REFRIGERATORS.—A nationally known wholesale electrical distributer has contracted with a Middle Western manufacturer for a line of household electric refrigerators. These will be announced shortly.

PLATINUM CONTACT POINTS.—That the platinum contact point situation is not at all hopeless on account of shortage is evident from the fact that a Chicago firm is taking steps to place a line of this material through the electrical trade.

CEDAR POLES.—The producers claim that very few poles are being bought.

ATLANTA

Substantial rains fell this week, covering a large area of the Southeast, which has put the water-power companies in good shape for a while at least. Power curtailment by the War Industries Board has been very drastic during the past few weeks, in order to allow essential war plants to operate at capacity.

CONDUIT.—The latent demand for both white and black rigid awaits expansion as soon as restrictions are lifted. Manufacturers state that there are large quantities in factory stock and in process of manufacture, but this can only be released by the presentation of proper priority on account of big shipments being made to shipbuilding centers and government demand, which has shown a healthy increase in the last six months. Southeastern stocks are low and are estimated to be only 25 per cent of normal. Prices show no change. Warehouse shipments are up two to four points.

MOTORS.—During September a very good business was transacted in capacities up to 100 hp., but sales this month so far are somewhat off. Priority affidavits tend to retard sales.

PANELBOARDS.—Factory facilities have improved, but the call for these has fallen off following the speculative building situation. Shipments can now be made in two to three weeks.

STAMPED STEEL BOXES.—The volume of sales through commercial channels has sagged considerably but has been offset to some extent by heavy requirements from shipyards.

FLEXIBLE STEEL CABLE.—This and flexible conduit are moving freely, owing to the fact that the restrictions are less drastic than for rigid conduit. Jobbers state that the demand has increased sharply of late. Prices remain firm, ranging approximately 5 per cent above rigid conduit. So far there are ample stocks to handle all requirements.

ELECTRIC HOISTS.—The scarcity of labor has directed attention to this type of labor-saving device, and manufacturers report an increasing number of inquiries from all classes of industrials. Sales for government account are holding up well, and it is expected that this condition will exist for some time. Shipments for ordinary channels run from two to six months. Shipyards and lumber plants can secure equipment in about half this time. There has been no change in price during the past two months.

SEATTLE—PORTLAND

Seattle jobbers particularly report a heavy volume of sales the past week. Of note were large orders placed by the Norway Pacific Shipbuilding Company, Everett, for heavy power apparatus and electrical equipment for its plant nearing completion. Siems-Carey interests engaged in lumber logging and railroad building in the Olympia peninsula district recently placed heavy orders, as did the Standifer shipyard, Vancouver, Wash. The volume of sales to shipyards in Seattle also showed a decided increase over the past several weeks. Large Seattle jobbers assert the Christmas trade will be confined almost exclusively to those household devices which are still on the essential list. Even sales on these are not expected to approach last year's volume. Ordering for Christmas tree outfits and electrical novelties is very light and jobbers do not expect deliveries. The labor situation shows little if any improvement. Jobbers report that shortages heretofore reported still obtain. Rubber-covered wire in large sizes is hard to get, and smaller sizes are practically off the market. The Portland territory reports a temporary shortage in stocks of 50-watt and 100-watt types "Mazda C" lamps, although shipments are on the way. Stocks of miniature lamps are slowly improving. Other sizes are in good shape.

Orders were placed during the week for an aggregate of over 1500-kw. capacity in transformers for the new steel rolling mill of the Pacific Coast Steel Company. The Portland Coast Power Company, Tillamook, Ore., is working on a new 20-mile, 6600-volt transmission line from Tillamook to Brighton.

The rainfall of the past three weeks has materially improved water-power conditions, but much more is urgently needed at the present time to relieve conditions at steam plants. A permit has been received from the War Industries Board by the Northwest Trust Company to erect 100 homes for war workers in the peninsula district, Portland, costing from $1,200 to $1,700 each. The Spanish influenza epidemic in the Northwest is materially affecting the electrical industry, especially in Portland. Not only are many employees of various concerns suffering, but owing to drastic closing orders of the Board of Health prohibiting all public gatherings, earnings of public utilities have been reduced. Closing of churches, schools, theaters and similar places has made an appreciable decrease in lighting revenues.

The volume of sales of some farm-lighting outfits during the past month was heavy, especially in eastern Washington, the Inland Empire section and eastern Oregon. Stocks, in spite of heavy demand, are in fair shape. Demonstrations at county fairs are constantly bearing fruit. Washing machines are selling well. Stocks are practically nil and shipments extremely hard to obtain. The movement which has been strong for months shows no signs of declining. Collections are excellent and expected to continue to be so.

SAN FRANCISCO

Inasmuch as all unessential construction is being eliminated, it is natural that Pacific Coast business should be affected. The United States Navy representative sent to look over the field has decided to discontinue the projected Liberty shipbuilding plant near Oakland on the ground that it is difficult to secure sufficient steel now for existing plants. The industrial housing work at Clyde has been cut down from 350 to 103 cottages, which incidentally will be wired for, but not equipped with, electric ranges. On the other hand, the Mare Island Navy Yard, a permanent government plant, will be equipped with 210 one-and-a-half-story frame dwellings. In other lines of government activity, especially the air service, additional activity is noted. New hangers for San Diego, enlarged airplane factories near Sacramento and an additional hospital at the Whipple Barracks in Arizona are recorded for immediate construction. Private construction is necessarily small. As an indication of September building, San Francisco building permits were 242 in number and aggregated $757,000; Oakland permits for the same period, 333, amounting to $564,000, and those of Los Angeles 520, aggregating $724,000.

CREDITS AND COLLECTIONS.—Conditions were better in September than in the two previous months, possibly because 1918 crop money was placed in circulation.

TRANSFORMERS.—Very few sales are reported, as practically no new extensions are being made. The few tying-in lines are designed as through connections and not as feeders to the territory through which they run, at least at the present time. As work on these lines proceeds considerable pole-line hardware business is anticipated.

WASHING MACHINES.—The new prices, averaging $130 for the family machine, have not influenced business, which has been excellent. But the chief detriment to an increase of business over last year's showing has been the lack of stock. Several jobbers report big shipments on orders placed a long time ago, and their salesmen are again soliciting business.

FIBER.—Stocks are fair and demand is excellent. It is reported that a new factory is to be established at Kingman, Ariz., where fiber will be manufactured from Yucca and the Spanish bayonet plants. This is an innovation whose progress is followed with considerable interest.

LAMPS.—Local lamp stocks are good. The demand is steady, and so far few orders for winter requirements have been received. The Oakland lamp factory has informed its customers that only a percentage of orders covering frosted lamps can be filled by it, owing to its inability to secure necessary apparatus, and it furthermore requests its customers to do all possible to cut down the demand for frosted lamps.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

No. 14 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%
No. 12 Solid	
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid	
Less than coil	+20% to $73.20
Coil to 1000 ft	List
No. 12 Solid	
Less than coil	+20% to $85.20
Coil to 1000 ft	List

Twin-Conductor

No. 14 Solid	
Less than coil	$115.00
Coil to 1000 ft	100.00
No. 12 Solid	
Less than coil	+20% to $162.00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
2 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0.45	$0.40 to $0.45
12 to 50	.35 to .39	.35 to .39
50 to barrel	.319 to .362	.329 to .382
Barrel lots	.289 to .332	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
⅝	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.75 to $64.25
⅜-in. double strip	78.25 to $90.00	71.25 to 75.00
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00 to 120.00	93.00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅜	$0.05½	1	$0.25
½	.06	1¼	.33
⅝	.09	1½	.40
¾	.12	1¾	.47
⅞	.15	2	.55
1	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$25.00–51.70	$24.60–35.20	$23.00–30.25
½-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$44.00–60.00	$30.00–33.00	$26.50–29.15
½-in.—	48.00–65.00	33.50–36.00	29.00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	⅛ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7.1%	9% to 9.1%
2500 to 5000 lb.	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	⅛ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +5%	+5% to 1%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7.00
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $9.37
1/5 to std. pkg	5.25 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.47—$40.77
Coil to 1000 ft	27.42— 30.22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $34.00
1/5 to std. pkg	17.85 to 28.90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16.80–24.15
1/5 to std. pkg	15.80–21.00

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg	$16.00 to $22.00	$32.00
1/5 to std. pkg	13.60 to 18.70	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg	$11.70–$24.00	$33.85–$36.80
1/5 to std. pkg	10.15– 20.00	26.60– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	2% to 5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net to 30%
$2.00 to $10.00 list	10% to 35%	5% to 40%
$10.00 to $50.00 list	20% to 37%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to 6.50
Discount	20% to 30%

CHICAGO

List price	$6.00 to $6.50
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.51–$0.66
No. 18, full spools	.49– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.72
No. 18, full spools	.595 to .65

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00–$25.00	$15.00–$17.00	$15.00–$15.75
12	23.58– 27.09	21.62– 29.09	17.68– 23.22
10	30.20– 37.80	27.45– 32.40	23.47– 32.40
8	42.74– 53.34	38.85– 45.72	33.21– 45.72
6	61.50– 84.42	55.35– 72.36	52.58– 55.48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14		$25.00	$18.00–$25.00	$15.50
12	$29.46– 31.44	29.46– 31.44	$25.54– 31.44
10	41.10– 43.84	41.10– 43.84	34.62– 38.36
8	57.00– 61.76	57.90– 61.76	50.18– 54.04
6	85.31– 97.68	85.31– 85.47	72.21– 85.47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39.75 to $44.00
25 to 50 lb	39.75 to 42.00
50 to 100 lb	38.75 to 40.00

CHICAGO

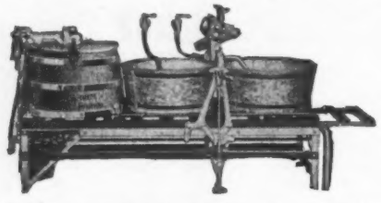
	Per 100 Lb. Net
Less than 25 lb	$41.00 to $41.76
25 to 50 lb	39.75 to 40.76
50 to 100 lb	38.75 to 39.76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Platform-Type Electric Washer

Convenience is claimed as the chief feature of the platform washer now being put out by the Voss Brothers Manufacturing Company, Davenport, Iowa. This machine, which is known as "E-12," has a peg-type dasher. It not only does the washing but takes care of rinsing, wringing and draining as well, without the necessity of lifting the tubs either during the washing or after it is finished. The sliding wringer attachment and the drain from the tub make this heavy labor unnecessary, according to the makers.



LIFTING TUBS ELIMINATED BY SLIDING-WRINGER ATTACHMENT AND DRAINS

The sliding-wringer feature serves to make it possible to operate the wringer in either direction from any place on the bench. Double control gives the user convenience, speed and safety in operation. The hand lever placed conveniently at the top of the side frame enables the operator to start, stop or reverse the wringer by hand alone. A foot attachment is also provided which permits the operator to use both hands in rinsing the clothes and in feeding the wringer, starting and stopping the wringer at will by application of slight pressure on the foot treadle.

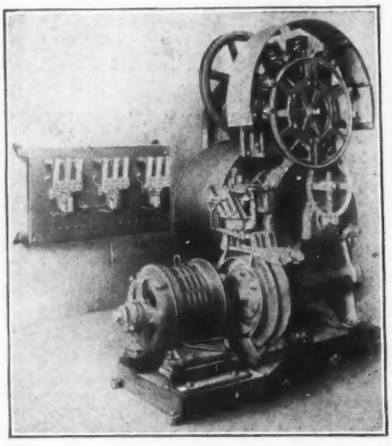
Simple Control for Squirrel-Cage Elevator Motors

An elevator control to be used with squirrel-cage motors in sizes up to and including 20 hp. at car speeds not exceeding 150 ft. (45.7 m.) per minute has been designed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for both freight and passenger service. The equipment of this elevator control, type E, is extremely simple, consisting of a small control panel mounted on the wall somewhere near the motor, a car switch by means of which the operator controls the movement of the elevator cars and such elevator safety devices as may be desired. A line contactor and two mechanically interlocked directional contactors are mounted on a black marine-finished slate base. The motor, being started with full-line voltage, requires no secondary or accelerating contactors.

The equipment is simple in construction and quiet in operation. All parts are easily accessible for inspection or repairs. The contacts are graphite to graphite of the butt type (no sliding contacts used) and are interchangeable for the various contactors. The same contacts may be used for alternating-current and direct-current type E controllers for both car-switch and push-button operation.

The car switch closes the line contactor and one of the directional contactors and thus starts the car in the desired direction.

Westinghouse type E brake magnets are recommended for use with this equipment. When the operator by means of the car switch closes the circuit through the contactors a shunt circuit energizes the brake magnet and releases the brake. If the car switch is returned to the "off" position or if any of the safety devices operate, the control circuit is opened, the brake magnet is de-energized and the brakes are immediately applied.



CAR-SWITCH ELEVATOR ALTERNATING-CURRENT CONTROL

The safety devices most commonly used are the emergency switch to be used by the operator in case of accident to the car switch; machine-limit and hatchway-limit switches, which operate automatically to prevent accidents from over-travel should the operator for any reason fail to release the car switch, and door interlocks, which prevent the starting of the car until the door is properly closed.

The car-switch elevator control (type E) is used with alternating-current squirrel-cage motors of 20 hp., 220, 440 and 550 volts, 25-cycle and 60-cycle, two-phase and three-phase types.

Reflector-Type Fixture

As an addition to its line of "Standard-Lite" units the Standard Brass & Bronze Manufacturing Company, 636 Penn Avenue, Pittsburgh, Pa., has developed a new unit for 100-watt type C lamps, which it designates as its No. 6104 unit. The reflector diameter is 18 in. (45 cm.) and the bowl diameter 10 in. (25 cm.). The fixture is designed for efficiency and economy and is of a type especially adapted for stores, offices, schools, churches, libraries, banks and other public buildings.

High-Current Pull Switch

For use with conduit wiring a pull switch has recently been placed on the market by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. It has a one-piece white-glazed porcelain base which entirely covers a standard 3¼-in. (7.1-cm.) outlet box. Two screws furnished with the box are used to attach the switch. The shell lock for fastening the shell to the base is the same as those used on all Cutler-Hammer push sockets as well as on other types of this firm's pull switches.

The mechanism used consists of two pieces of porcelain fastened together and containing a rotary switch movement operating on a steel shaft. There are two holes in the halves of porcelain arranged to permit feeding the supply wires through them. This prevents vibration and operation of the switch from loosening of the contact screws.

PULL SWITCHES USEFUL IN CONDUIT WIRING

Having a capacity rating of 6 amp. at 125 volts instead of the usual 3 amp. at the same voltage, the switch is said to be of particular value for controlling large groups of lamps or high-wattage lamps.

Interchangeable Service Entrance Fittings

The Appleton Electric Company of Chicago has designed two entrance fittings, one for service entrance and the other for outside conduit installation. The first has been designed to meet the demand for a small, light and dur-

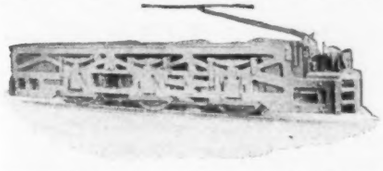
CONNECTIONS TO THESE FITTINGS MAY BE MADE EASILY

able entrance. The same parts are used for ½, ¾ and 1-in. (1.3, 1.9 and 2.5-cm.) fittings, excepting the hub, a separate hub being required for each size. Interchangeability is one of the features of this fitting, the top cover and also the porcelain covers being interchangeable on all sizes. The top cover is removable, allowing for a straight pull of the wires, and connections may be made without difficulty. This fitting may be used either on vertical or horizontal conduit.

The second fitting for outside conduit installation is a neat, short right-angle fitting. This fitting is perfectly smooth on the interior, and the corners are rounded so as to prevent any injury to wires. The cap is well finished so that it will sit right on the fitting, and the result is a weatherproof entrance. Black enamel and galvanized are the standard finishes for the above fittings.

Powerful Mine Locomotive

An important need of present times is the replacement of mule teams in mining work by electric locomotives. This releases the drivers for other important work in the industry. A powerful electric locomotive of the Baldwin-Westinghouse type is furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. The frame is of especially



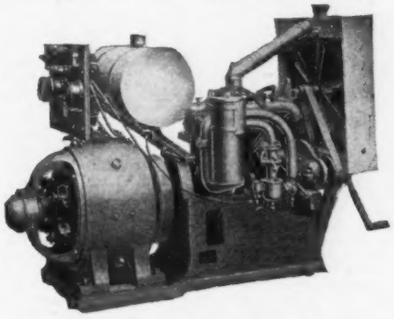
REPLACES MANY MULE-AND-MAN TEAMS

heavy and rugged construction and is driven by traction motors of the interpole type. The electrical equipment is much like that found on trolley cars with magnetic blow-out controllers, fuse and circuit breakers of the car type. Two incandescent headlights are provided in heavy iron casings with iron bars protecting the glass. Trolleys are provided to give adjustable contact pressure and also for adaptation to a variation in the height of the trolley wire. This is essential when the locomotive operates through passageways of limited head room.

Private Electric Lighting Plants

Two general styles of gasoline-engine-driven electric lighting plants are being manufactured by the Langstadt-Meyer Company, Appleton, Wis. One type consists of a gasoline engine belted to a generator designed to supply energy to installations on farms, in summer homes, resorts, country stores, public buildings, garages, etc., in conjunction with an electric storage battery. Of this type three sizes are made, namely, a 40-light to 60-light size, an 80-light to 100-light size and an 80-light to 110-light size. The engine used is a 3-hp., four-cycle single-cylinder machine, and the battery is of the Faure type. The outfit is sold complete with engine, generator, battery, switchboard, gasoline and water tanks.

The other type of plant consists of a direct-connected four-cylinder gasoline engine and a 5-kw. electric generator. It is designed, the manufacturers say, to supply electric light and power at low cost of operation and maintenance wherever central-station service is not available or where a self-contained portable unit is required. These machines are offered to supply demand for a high grade, simple, compact, reliable, medium-weight, low-speed unit. The outfit is intended for continuous operation, and for this reason no storage battery is sold with the standard set.



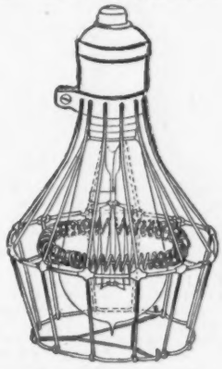
DIRECT-CONNECTED PLANT IN ONE COMPACT UNIT

Linemen's Straps and Belts

For use by linemen T. J. Cope of 1620 Chancellor Street, Philadelphia, is marketing a line of leather belts and straps. A belt of black harness leather, 2¼ in. (5.7 cm.) in width, has two heavy "D" rings, six loops for tools and a strong buckle, and may be obtained in five sizes. A safety strap 1¾ in. (4.5 cm.) wide and 6 ft. (1.8 m.) long is provided with an extra strong snap at each end, while a combined safety vise or jack strap 1¼ in. (3.2 cm.) by 5½ ft. (1.7 m.) is made of selected harness leather and may be had with or without snaps. Climbers' straps are also being made, a set consisting of two upper and two lower straps with pads 4 in. by 4 in. (10.2 cm. by 10.2 cm.).

Wire Guard for Lamp Protection

For protecting lamps from breakage and unauthorized removal, W. N. Matthews & Brother, Inc., of St. Louis, Mo., are marketing the "Holdfast" lamp guard shown in the accompanying illustration. The manufacturer says



PREVENTS THEFT AND BREAKAGE

that the guard transfers shocks, jars and vibrations to the lamp socket, and these are then dissipated by the lamp cord. The framework of the guard consists of two rings, one around the widest portion of the bulb and the other above the lamp tip, which are connected to the clamping and locking collar on the socket by a number of vertical bars. The lamp is protected from blows and jars by these rings and the bars, while a spring cushion, which is the only part of the device touching the bulb, will absorb shocks and vibrations that tend to break the lamp at its neck. Both the lock on the collar and the trap lock at the lamp's point are said effectually to prevent the theft of lamps. The guard has a 1-in. (2½-cm.) clearance and can be stood on the end ring without the useful downward rays of light from the lamp being obstructed.

Crosses for Christmas Trees

A line of miniature incandescent lamps for use on Christmas trees and for other decorative purposes is being offered to the trade by the A. C. Mann-

APPROPRIATE FOR CHRISTMAS TREES

weiler Company, Inc., of Fort Wayne, Ind. The lights may be obtained in red, white and blue, as well as in other colors, and are said to be both safe and durable. A new design in the form of a cross is illustrated.

Trade Notes

RIGHT OF COMMERCIAL TRAVELERS IN SOUTH AMERICA.—A treaty designed to protect rights of commercial travelers has been ratified between the United States and Uruguay. The treaty limits right to license or tax commercial travelers to the federal government of each country and provides a uniform plan for certification of samples. Negotiations are in progress for similar treaties with other Latin-American countries.

INDEPENDENT LAMP MANUFACTURERS ACQUIRE INTEREST IN LARGE BULB PLANT.—The Independent Lamp & Wire Company, New York City, and the Novelty Incandescent Lamp Company, Emporium, Pa., have acquired an interest in the Rochester Bulb Company, formerly the Rochester Tumbler Company, Rochester, Pa., which commenced to manufacture bulbs two years and a half ago and has now devoted its entire plant to the making of bulbs only. Five hundred people are employed, and the daily output is 100,000 bulbs with every probability of further increase. Officers of the company are: President, B. G. Erskine; treasurer, A. P. Saas, who is also treasurer of the Independent Lamp & Wire Company; vice-president and manager of the plant, Charles Runyon, and vice-president, M. L. Hofheimer, who is also vice-president of the Independent Lamp & Wire Company. Management of the factory will be retained by Charles Runyon, who was formerly president of the Rochester Tumbler Company and is very well known throughout the glass trade. General offices of the company will be at 1737 Broadway, New York City.

SEVENTEENTH ANNIVERSARY OF HYGRADE LAMP COMPANY.—The Hygrade Lamp Company, Salem, Mass., is commemorating the seventeenth anniversary of its establishment by issuing a special number of the *Hygrade Triangle*, the company's publication for employees. An interesting account of the growth of the concern is included, with many personal reminiscences from those who have led and have been closely identified with its work since the early days of the organization. The floor space has incerased from 5400 sq.ft. to about 60,000 sq.ft. and the invested capital from $3,500 to $500,000 since 1901. The company started business with one bookkeeper and now has an office force of fourteen members and a total payroll of about 360 employees. The enterprise started in Middleton, Mass., and was soon moved to Danvers, F. A. Poor, now treasurer and general manager, and Matthew Merritt being the organizers of the concern. In the early days it was known as the Bay State Lamp Company, and refilling was the principal business handled. In 1909 Mr. Poor took up the manufacture of carbon lamps under the present company name, and two years later, with Walter E. Poor, now assistant general manager, in charge of the development, the manufacture of tungsten lamps was begun. The low-voltage tungsten sign lamp was first put in production on account of the ease of manufacturing the short V-filament lamp and the ease of reaching a market for this product. In the fall of 1912 the manufacture of regular 25-watt to 60-watt tungsten lamps was begun. Up to the beginning of the war the company obtained practically all its bulbs and filament wire from Australia. In 1913 the refilling of lamps was discontinued entirely, and the outbreak of the war found the company making but one-third carbon lamps in its output. Two years later the company began making wire-drawn filaments on its own account, and the lamps resulting gave better service than those made with foreign wire. In 1916 the company moved into its new factory at Salem. The plan of distributing Hygrade lamps through jobbers was started about this time, and in 1917 a license agreement under the Just and Hannaman patent was signed with the General Electric Company. In 1917 the company attained a production rate of 13,000 lamps per day, 7 per cent of which were of the gas-filled type. By the summer of that year it became necessary to increase the floor space and a two-story brick storehouse was erected which added about 50 per cent to the plant area. The organization is well represented in the army and navy, and the employees exceeded their quota of $21,000 by $5,150 in the fourth Liberty loan, the total subscriptions, with that of the company, aggregating $41,150. E. J. Poor, president and sales manager, and J. H. Poor, director, are also receiving congratulations on the company's anniversary.

EXPORT LICENSE PROCEDURE FOR SAMPLES.—The War Trade Board announces in a new ruling (W. T. B. R. 280) the regulations governing the exportation of samples of no commercial value to be used in the solicitation of orders.

GOVERNMENT ORDERS AND CONTRACTS.—The hardware and metals division of the Quartermaster General's Department is calling for bids on or before Nov. 5 on sixty 2-qt. electric glue pots, tinned inside, complete with cord and attachment plug for use on 220 volts, American Electric Company or equal.

RETURN OF MATERIALS FOR REPAIRS OR CREDIT.—The Westinghouse Electric & Manufacturing Company, New York office, is notifying customers that strict compliance with certain rules relative to the return of materials for credit and repairs will assist greatly in avoiding unnecessary delay and confusion. Customers in the New York district are urged under no condition to return any material whatever until they have first secured proper shipping instructions from the New York office and then not to neglect to mention class and style of material when entering request. This action, it is pointed out, is made necessary because of the return in many instances of material intended for the New York service department to the East Pittsburgh, Newark or Mansfield works while other material intended for the works has gone to the service department or to the New York office. In the future the company will assume no responsibility unless these conditions are complied with.

WIRE DELIVERIES BY AËROPLANE.—Speed of delivery since this war began has been one of the chief virtues of an electrical jobbing house, and the Richmond (Va.,) branch of the Western Electric Company has set a new record in that respect by delivering some wire by aëroplane. The government furnished the aëroplane, to be sure, but to the Richmond house belongs the credit for devising the plan. Here is the story as told by J. B. Odell, manager of the Richmond branch, in a message sent at the very moment that the aëroplane was delivering the goods: "Richmond has, I believe, the distinction of being the first Western Electric house to deliver its goods by aëroplane. The supply officer at Langley Field (aviation experimental station), Hampton, Va., about 100 miles away, called up this morning and stated that they were in great need of some weatherproof wire. Of course we had it in stock, and they asked us how quickly we could get it to them. We suggested express, which would have delivered the goods at Hampton to-morrow morning, but that was not quick enough for the government's needs. We then proposed that they give us the use of an aëroplane, as affording the quickest possible means of getting the goods to Hampton. Speaking literally, they took us up, and they will have the wire down there within three or four hours after they called us."

THE NATIONAL TUBE COMPANY of Pittsburgh, Pa., continues to add to its property holdings in the neighborhood of its works at Dravosburg. Following its purchase of thirty acres, it has now acquired seventeen acres more from the Pittsburgh Coal Company, as well as thirty lots on Washington Road. The company's purchases now aggregate fifty-one acres.

THE WALTER A. ZELNICKER SUPPLY COMPANY announces the appointment of R. H. Wilson as assistant to the president, with office at St. Louis. Mr. Wilson, who has been with the company for years, latterly as Houston representative, is succeeded there by B. O. Griffin, for the past twenty years storekeeper and assistant general manager of the International & Great Northern Railroad and more recently assistant to president of the St. Louis Southwestern Railroad in charge of purchases.

THE ALLIS-CHALMERS MANUFACTURING COMPANY, Milwaukee, Wis., has been making strenuous efforts to meet the war need for centrifugal pumps and has just recently caught up with the increased volume of business. As a result it now has a number of type "S" centrifugal pumps in sizes from 2 in. to 20 in. completed and ready for prompt government or other priority orders. The smaller sizes are in more plentiful supply. From six to twenty-five days, according to size of pump, are required for shipment, this time being the time necessary for making suitable common-base plates for mounting pumps and Allis-Chalmers motors. The company further states that it has a reasonable supply of motors in stock suitable for a portion of these pumps.

Trade Publications

FUSES.—Data and oscillographic tests of the "S. & C" carbon-tetrachloride fuses are given, with illustrations of their applications to inside and outdoor service, in a leaflet prepared by the Delta-Star Electric Company of Chicago.

INCLOSED SWITCHES.—Illustrating and describing the Trumball Electric Manufacturing Company's line of externally operated safety switches, the Julius Andrae Sons Company of Milwaukee is distributing an eight-page catalog known as revised circular No. 37.

HOUSEHOLD MOTOR.—The Hamilton-Beach Manufacturing Company, Racine, Wis., is distributing to retailers a circular reproducing two Hamilton-Beach "Home" motor advertisements that are being run in two national women's magazines and containing a card for procuring selling helps.

BELT FASTENERS.—The subject of belt joining is treated in a humorous way by the Crescent Belt Fastener Company of 381 Fourth Avenue, New York City, which has prepared a twenty-four-page booklet entitled "Gone Again," pointing out the advantages of "Crescent" belt fasteners in a "movie" drama. Copies may be had upon application.

LIGHT AND POWER PLANTS.—Its line of "Perfection" automatic and semi-automatic light and power plants for use on farms is fully described in a twenty-four-page booklet from the Perfection Storage Battery Company, Fortieth Street and Rhodes Avenue, Chicago. Information is also given about its "Jupiter" belt-driven plants and the lighting fixtures and appliances sold by the company.

ATTACHING CAP.—"C-H Standard Attaching Devices" is the title of a two-color envelope folder being distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The "Standard" attaching cap illustrated and described therein fits twenty-one of the various attaching devices of this company, as well as the standard plugs and receptacles of five other makers. Prices and listings of the complete line of attaching devices are also given.

New Incorporations

THE PITTSBURGH (PA.) GENERATOR COMPANY has been chartered with a capital stock of $50,000 to manufacture generators, etc. The incorporators are: F. Giles, M. M. Clancy and J. J. Kennedy.

THE METAL TOP BATTERY COMPANY of Oakland, Cal., has been incorporated with a capital stock of $50,000 to manufacture batteries. The incorporators are: D. R. Young, Henry Milan and George L. Tarver.

THE ATLANTIC & PACIFIC POWER COMPANY of Augusta, Me., has been incorporated with a capital stock of $900,000 to develop and deal in water powers, especially tides, currents and waves of the ocean, etc., to generate electricity.

THE ELECTRIC KITCHENET COMPANY, Dover, Del., has been incorporated with a capital stock of $500,000 to manufacture electrical specialties. The incorporators are: M. L. Rogers, L. A. Irwin and W. G. Steigler, of Wilmington, Del.

THE HOT FLO UTILITIES COMPANY of New York, N. Y., has been incorporated by S. O. Simons, H. Frantzen and H. Remington, 302 West 102d Street, New York City. The company is capitalized at $50,000 and proposes to manufacture electrical supplies, etc.

THE STANDARD APPLIANCE COMPANY OF AMERICA of New York, N. Y., has been incorporated by E. Goodman, J. L. Volz and N. Shaw, 32 Cooper Square, New York, N. Y. The company is capitalized at $95,000 and proposes to manufacture general telephone apparatus.

THE PROCESS ENGINEERS of New York, N. Y., has been incorporated by J. A. Kellogg, H. J. Alheim and E. Ackley, 15 Broad Street, New York City. The company is capitalized at $200,000 and proposes to do a general chemical, electrical, consulting and contracting engineering business.

New England States

WINN, ME.—The local electric light plant, owned by Robert Carll and Henry Whitney, was recently destroyed by fire.

NASHUA, N. H.—The Board of Aldermen has granted the Connecticut River Power Company of Worcester permission to extend its electric transmission line into Nashua to supply electricity to certain industries here.

WORCESTER, MASS.—Plans have been prepared for the erection of a new boiler house, 50 ft. by 70 ft., at the works of the Rockwood Sprinkler Company, 56 Harlow Street.

EAST NORWALK, CONN.—The voters of the Third Taxing District have authorized the Commissioners of the district to enter into a contract with the Connecticut Light & Power Company to furnish electricity for operating the local system for a period of ten years; also to purchase the distributing equipment of the Connecticut company and connect it with the lines of the district. The municipal electric generating plant will be closed down and the machinery sold.

GROTON, CONN.—The taxpayers have authorized the Board of Water and Light Commissioners to enter into a contract with the Shore Line Electric Railway Company, 362 Main Street, Norwich, for electricity to operate the municipal electric light system. Energy will be secured from the Montville power plant of the Eastern Connecticut Company. The cost of installing the new system, including transformers, wiring, insulation, etc., is estimated at $20,000.

NEW LONDON, CONN.—Contract has been awarded by the Navy Department, Washington, D. C., to James Miles & Son of Worcester, Mass., for the erection of two sub-charging stations at the local government site, to cost about $16,837.

Middle Atlantic States

ALBION, N. Y.—Bids will be received by John L. Reilly, acting president board of managers of the Western House of Refuge, Albion, N. Y., until Nov. 12 for electric work and rewiring four cottages at the Western House of Refuge for Women at Albion. Plans and specifications may be consulted at the above institution, at the New York office of the Department of Architecture, Room 1715, Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

AMSTERDAM, N. Y.—The Schenectady (N. Y.) Illuminating Company has petitioned the Public Service Commission for permission to erect an electric plant in Amsterdam.

BUFFALO, N. Y.—Contract has been awarded by the Republic Carbon Company to the Lackawanna Bridge Company, Bell and Abbey Streets, Buffalo, for the construction of four new factory buildings at its works.

LA SALLE, N. Y.—Plans have been filed by the La Salle Electric Corporation for the construction of a new transformer station, 25 ft. by 35 ft., to cost about $10,000. Contract for the building has been awarded to Fred Brooke of La Salle.

LYONS, N. Y.—The local electric plant of the Niagara, Lockport & Ontario Power Company was damaged by fire on Oct. 20, causing a loss of about $200,000.

NEW YORK, N. Y.—Plans have been prepared for the erection of a new boiler house, 30 ft. by 30 ft. by 30 ft., at the Roosevelt Hospital, Ninth Avenue and Fifty-ninth Street.

NEW YORK, N. Y.—Work has begun in connection with the remodeling of the Grand Central Palace, Lexington Avenue and Forty-sixth Street, recently taken over by the government, to be known as the Debarkation Hospital No. 5. Considerable electrical equipment will be required for the proposed improvements.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 11 for construction of electric shop and light machinery at the local navy yard, under Specification 3551, to cost about $800,000.

NIAGARA FALLS, N. Y.—Plans have been prepared by the Acheson Graphite Company, Buffalo Avenue and Portage Street, for the erection of three new factory buildings on the River Road, Tonawanda, 40 ft. by 40 ft., 65 ft. by 100 ft. and 40 ft. by 80 ft. respectively. Contract has been awarded to the J. W. Cowper Company, Fidelity Bank Building, Buffalo.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

OGDENSBURG, N. Y.—Plans are under consideration by the Ogdenburg Power & Light Company for the erection of a new office building on Ford Street near Catherine Street, to cost about $10,000. Williams & Johnston, 40 Ford Street, are architects.

TONAWANDA, N. Y.—The Pierce-Arrow Motor Car Company has awarded contract for the construction of a new boiler plant in connection with its proposed new works on the River Road to the J. W. Cowper Company, Fidelity Building, Buffalo, N. Y.

BLOOMFIELD, N. J.—Contract has been awarded by the Sprague Works of the General Electric Company to the Salmond Brothers Company, 526 Elm Street, Arlington, for the erection of its proposed new pattern shop, to cost about $50,000.

JERSEY CITY, N. J.—Plans are being prepared by the Continental Can Company, 111 West Washington Street, Chicago, Ill., for the construction of three and four buildings between Fifteenth and Sixteenth Streets, to cost about $500,000.

PENNS GROVE, N. J.—The Salem & Penns Grove Traction Company, it is reported, will build an extension to Pedricktown to connect with the Camden, Gloucester & Woodbury Railway, passing through Bridgeport, Paulsboro and Gibbstown.

TRENTON, N. J.—Work has begun by the Trenton & Mercer County Traction Company on the installation of new conduits in Lincoln Avenue, this being one of the steps in the elimination of electrolysis damage in Trenton. E. E. Brownell has been engaged by the city officials to suggest ways and means for overcoming this difficulty.

ARDMORE, PA.—Bids will be received at the office of the Commissioners of Lower Merion Township, Ardmore, until Nov. 26, for furnishing and installing a 125-hp. electric motor and centrifugal pump for pumping sewage at the Mill Creek pumping station, together with all necessary foundations, wiring, etc. Robely A. Warner is superintendent.

EASTON, PA.—Notice has been filed by the Pennsylvania Utilities Company of Easton with the Public Service Commission of an issue of $115,000 in notes. Part of the proceeds, it is understood, will be used for extensions.

EAST PITTSBURGH, PA.—Plans have been prepared for the erection of a new three-story building, 65 ft. by 70 ft., at the local plant of the Westinghouse Electric & Manufacturing Company.

HARRIMAN, PA.—Arrangements have been completed for the erection of an electric power plant at the local works of the Merchants' Shipbuilding Corporation.

HARRISBURG, PA.—Arrangements have been completed by the City Council for the installation of the proposed new police and fire-alarm systems. Clark E. Diehl is city electrician.

NORTHEAST, PA.—The installation of an electric light plant is reported to be under consideration by the Borough Council.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Electric Storage Battery Company to F. P. E. Aubel, 2503 Germantown Avenue, for the erection of two two-story buildings, about 49 ft. by 118 ft. and 30 ft. by 40 ft., respectively, at Ontario and C Streets.

SHARON, PA.—Arrangements have been completed by the Savage Arms Corporation, 50 Church Street, New York, N. Y., for the construction of a new power plant, 88 ft. by 88 ft., at its local works. Contract has been awarded to the Stone & Webster Engineering Corporation, 120 Broadway, New York, N. Y.

THROOP, PA.—The Price-Pancoast Coal Company, Board of Trade Building, is planning to erect a new electric plant at its works. The proposed building will be about 80 ft. by 100 ft. and will cost about $75,000.

WEST NANTICOKE, PA.—Plans are being considered by Stapler & Boll, Mears Building, Scranton, for the construction of a coal breaker and stripping plant at West Nanticoke, to cost about $100,000. Frank B. Davenport, Coal Exchange Building, Wilkes-Barre, is engineer.

BALTIMORE, MD.—The United Railways & Electric Company is contemplating building an extension of its Sparrows Point line to the yards of the Bethlehem Shipbuilding Corporation.

BALTIMORE, MD.—Contract has been awarded by the Central Chemical Company for the erection of a new building at Race and Winder Streets, to cost about $155,000, to Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y.

CHARLESTON, W. VA.—Improvements are contemplated to the electric power plant and waterworks system of the West Virginia Water & Electric Company, including the construction of pumping station and intake from river, the installation of two electrically driven centrifugal pumps of 18,000,000 gal. daily capacity, reinforced concrete reservoir of 2,000,000 gal. capacity, addition to filter plant, including buildings, pipe, etc. They have a contract with the government to supply electricity and water to the naval ordnance plant at South Charleston. The Charleston Concrete Construction Company is contractor. James H. Fuertes, 140 Nassau Street, New York, N. Y., is engineer.

FAIRMONT, W. VA.—Extensions and improvements involving an expenditure of about $2,000,000 will be made by the Railroad Administration at Grafton and Fairmont, covering the lines of the Baltimore & Ohio Railroad, the West Virginia Northern Railroad and the Monongahela River Railroad. The proposed work will include car-repair shops, engine houses, new turntables, etc., and also housing facilities for employees. Arthur W. Thompson, federal manager, and E. E. Hamilton, assistant manager, have charge of the work.

HUNTINGTON, W. VA.—The Consolidated Light, Heat & Power Company will begin work at once on the erection of a 33,000-volt transmission line from Ashland, Ky, to Ironton, Ohio, a distance of 5 miles. D. L. Evans, line superintendent, will have charge of the work. Work has begun on changing the equipment of the substations of the company in Huntington, W. Va.; Ashland, Ky., and Ironton, Ohio, five in all. W. E. Salber, electrical superintendent, will have charge of the installations.

ALEXANDRIA, VA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Fleischman Construction Company, New York, for the construction of the local naval torpedo assembly plant at Alexandria at $1,075,000. Considerable electrical equipment and five large electric elevators will be installed.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 4, under Specification 3377, for electric light and power system and steel storage building, to cost about $6,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Washington, D. C., until Nov. 8, under Proposal 1150, for enameled conduit, locknuts and bushings.

WASHINGTON, D. C.—The Department of Labor has awarded contract for 77 buildings at Lowell, Mass., to the J. G. Poland Company of Quincy, Mass., and another contract for 152 buildings at Niagara Falls, N. Y., to the George W. Syfles Construction Company of Chicago, Ill.

WASHINGTON, D. C.—Contract has been awarded by the United States Housing Corporation (on a fee basis) to Moss, Taylor & Crawford, 701 North Sixty-third Street, Philadelphia, Pa., for the erection of a group of 40 dormitory and administration buildings on block bounded by Twenty-first, Twenty-third, B and C Streets, to cost about $2,500,000. Waddy B. Wood, 816 Connecticut Avenue, Washington, is architect.

WASHINGTON, D. C.—A favorable decision has been reached by the War and Navy Departments for the establishment of a belt line in Washington, D. C., to relieve the electric railway congestion in the center of the city and to accommodate the federal government workers in West Potomac Park. The proposed line will be used by both the Capital Traction Company and the Washington Railway & Electric Company. The plan involves the laying of new tracks over a portion of the route. The government will either build them or guarantee the cost.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and stations supplies as follows: New London, Conn., Schedule 6656½, signaling searchlight parts. Cape May, N. J., Schedule 6658½, engine generators. Norfolk, Va., Schedule 6601½, six air compressors; Schedule 6663½, three motor-driven lathes. Charleston, S. C., Schedule 6673½, one electrically driven crane and parts. Philadelphia, Pa., Schedule 6695½, one locomotive and motor-generator. Hampton Roads, Schedule 6701½, three conductor cable.

New York, N. Y., Schedule 6726½, one gasoline engine. Boston, Mass., Schedule 6730½, 50,000 ft. ignition wire. Navy Yard, Connecticut, Schedule 6731½, machine tools, including lathes, drills, grinders, tapping machine, hand press machines and induction motors. Puget Sound, Wash., Schedule 6732½, duplex and solid wire; Schedule 6733½, steel conduit. Mare Island, Cal., Schedule 6752½, 250 lb. phosphor wire. South Brooklyn, N. Y., Schedule 6782½, desk and bracket fans. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: South Charleston, W. Va., Schedule 1975—five motor-driven, 12-in. geared-head lathes. Mare Island, Cal., Schedule 1979—six ventilating sets. San Francisco, Cal., Schedule 1976—miscellaneous lead-covered electric cable, 650 ft. portable armored cable. Washington, D. C., Schedule 1976—miscellaneous duplex standard copper wire. Various, Schedule 1992—miscellaneous soft lead wire in 5-lb. spools; Schedule 1991—miscellaneous flexible, flat, fish-steel wire, miscellaneous mild, iron or steel welding wire, miscellaneous soft iron or steel wire, miscellaneous tempered spring crucible steel wire, 8850 lb. steel deep-sea sounding wire; Schedule 1993—miscellaneous phosphor-bronze wire, miscellaneous hard spring brass wire, miscellaneous hard copper wire, 1-lb. spools. New Orleans, La., Schedule 1991—miscellaneous annealed black iron wire. Applications for proposal blanks should designate the schedule desired by number.

North Central States

BELLAIRE, OHIO.—The City Council has granted the Wheeling (W. Va.) Traction Company a franchise to operate cars within the city limits.

CLEVELAND, OHIO.—The Cleveland Illuminating Company has notified the Lakewood School Board that it will not extend its high-tension service to a new building on Bunts Road unless the board will pay the cost of installation, which is estimated at $12,000.

HAWESVILLE, KY.—The local electric plant and waterworks system, owned by Henderson Williams, has been purchased by John Quissenberry, at $11,000.

MATTOON, ILL.—The H. W. Clark Company, it is reported, is rebuilding its factory, which was destroyed by a tornado last year. The plant will be equipped with electrically driven machinery. The plant, it is understood, is nearly completed.

SADORUS, ILL.—The village of Sadorus has placed a contract with the United States Electric Company of Peoria for equipment for the installation of an electric lighting system, at $6,000. Electricity for operating the system will be supplied from the Pesotum plant (8 miles distant) of the Central Illinois Public Service Company of Mattoon.

SOUTH PEKIN, ILL.—Contract for extensions to the local power plant of the Northwestern Railroad, it is reported, has been awarded to the G. A. John Company.

DEERWOOD, MINN. — The Cuyuna Range Power Company is planning to move its headquarters to Ironton in the near future. The company is making connection to the town of Motley with its distribution system and has recently purchased the pole lines in Walker and will furnish electricity for lamps and motors in the later place.

DULUTH, MINN.—The McDougal-Duluth Company, Fifteenth Avenue, is contemplating an addition to its shipbuilding plant, to cost about $750,000.

JANESVILLE, MINN.—Contract will soon be awarded by the City Council for furnishing and installing a two-stroke pump directly connected to a 20-hp slip-ring motor, three-phase, 60-cycle, 220-volt, alternating-current, capable of delivering 200 gal. per minute against a total head of 200 ft.

ST. PAUL, MINN.—Preliminary plans are being prepared by the Toltz Engineering Company, engineers, Pioneer Building, for the construction of a two-story building, 200 ft. by 250 ft., at University and Fairview Avenues, for Griggs, Cooper & Company, Third Street and Broadway, to cost about $350,000.

KANSAS CITY, MO.—The Kansas City & Leeds Railroad Company is considering the construction of an electric interurban railway from Thirty-first Street and Hardesty Avenue to Leeds, Mo., and thence to the Municipal Farm. Later on the railway will be extended to Lees Summit. W. E. Winner, W. E. Collins, Howard Ross and others are reported interested in the project.

ST. CHARLES, MO.—Following an adverse ruling of the Public Service Commission, which denied the application of the American Light & Power Company of St. Charles for permission to collect a monthly surcharge of 50 cents, the company, as a matter of economy, will be compelled to dismantle and junk the local municipal electric plant, maintained for emergency purposes.

ST. LOUIS, MO.—The George F. Wyland Building Company is contemplating building a garage in connection with the construction of a new mercantile building, to cost about $132,000.

SLATER, MO.—An election will soon be held to vote on the proposal to issue $25,000 in bonds for improvements to the municipal electric light plant. The installation of new boilers is included in the proposed improvements.

SWEET SPRINGS, MO.—The Farmers' Elevator & Grain Company is contemplating rebuilding its building recently destroyed by fire.

DORRANCE, KAN.—An election will soon be held to submit the proposal to issue $10,000 in bonds for the purpose of establishing a municipal electric light plant in Dorrance.

EMPORIA, KAN.—The plant of the Empire Electric Manufacturing Company was recently destroyed by fire, causing a loss of about $75,000. The company manufactures electric lighting plants for farms, etc.

HUTCHINSON, KAN.—Contract has been awarded to the Cates Electric Company of Hutchinson for electric wiring in the new hospital building of the Sisters of Mercy. The cost of the building is estimated at $100,000.

Southern States

FORT McPHERSON, GA.—The War Department is planning to erect hospital buildings at Fort McPherson, to cost about $500,000. General R. C. Marshall, Jr., Construction Division, Seventh and B Streets, Washington, is in charge.

JACKSONVILLE, FLA.—The City Council, it is reported, will soon award contract for the installation of a reciprocating air compressor belted to a 50-hp., 2200-volt, 60-cycle induction motor, compressor to travel not more than 200 r.p.m. and deliver 350 cu. ft. per minute at 100 lb. pressure.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company is considering improvements to its plant.

HAZEN, ARK.—J. D. Cash is reported to have been granted a franchise to operate an electric light plant in Hazen.

LITTLE ROCK, ARK.—The City Council is considering a proposition submitted by the merchants of Little Rock, recommending enlarging the municipal electric light plant in order that it may furnish electrical service to commercial consumers. At present the plant supplies street-lighting service only.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 12, for construction, complete, of three buildings for the United States Marine Hospital at New Orleans. Drawings and specifications may be obtained at the above office or from the custodian at New Orleans.

HARTSHORNE, OKLA.—An election will be called to vote on the proposal to grant a franchise to the Choctaw Power & Light Company of McAlester to construct and operate an electric light and power system in Hartshorne.

BRYAN, TEX.—Improvements to cost about $25,000 are reported to be under consideration by the Bryan Ice Company.

DALLAS, TEX.—The Texas Electric Railway Company of Dallas, it is reported, is contemplating the construction of an extension to the camp at Provident City, to cost approximately $25,000.

Pacific and Mountain States

BELLINGHAM, WASH.—The Morrison Mill Company is planning to replace its present generator with a turbo-generator of 1000 hp. capacity. The company has purchased electricity from the municipal electric plant for the past two years.

BURBANK, WASH.—The question of building a hydroelectric power plant at Five-Mile Rapids on Snake River in connection with the Burbank Irrigation project is reported to be under consideration. Electricity developed by the plant will be used to operate pumps for irrigation purposes and for lamps and motors for domestic and commercial use. The matter will be taken up with the Department of the Interior. F. J. Pingry is manager of the project.

EVERETT, WASH.—Work will soon begin on the construction of the power plant in connection with the new shipbuilding yards of the Norway Pacific Construction & Dry Dock Company in Everett.

SEATTLE, WASH.—The commissioners of King County have granted the Chicago, Milwaukee & St. Paul Railway Company a franchise to erect a high-tension electric transmission line from Snoqualmie Falls to Cedar Falls, and from Snoqualmie Falls through Preston, Issaquah and Renton to Renton Junction, for a period of thirty-eight years. The power will be used by the company in connection with equipping its main line from the crest of the Cascade Mountains to Seattle and Tacoma for electrical operation.

FLORENCE, ORE.—The Florence Mill, Power & Light Company, recently incorporated with a capital stock of $30,000, proposes to operate an electric plant in Florence.

BANNING, CAL.—Marcus Pluth of Los Angeles is interested in a project to establish a large cement plant at Whitewater. The plans of the promoters include developing the water power of Snow Creek and Whitewater River, to generate electricity, part of which will be utilized to operate the cement works. Under the present plans the waters of Snow Creek, after being released from the power plant, will be used for irrigation and domestic purposes in the Imperial Valley.

EUREKA, CAL.—The Western States Company, it is reported, has decided to erect an aerial transmission line across the bay to replace the submarine cable recently destroyed. At present electricity for the local service is being supplied by the electric generating plant of the Hammond Lumber Company.

MILLSAPS, CAL.—Application has been filed with the State Water Commission by Omer S. Avery of Millsaps for permission to appropriate 40 miners' inches of the waters of Heifer Creek, a tributary to Stony Creek, for power purposes. The cost of the proposed works is estimated at $10,000.

NOGALES, ARIZ.—Application has been filed with the State Corporation Commission by the Arizona Gas & Electric Company for permission to issue $100,000 in bonds, the proceeds to be used to pay a portion of the indebtedness incurred in the construction of its present plant and for an additional power unit, to cost about $30,000.

TORRINGTON, WYO.—At an election to be held Nov. 12 the proposal to issue $7,500 in bonds for the installation of an electric lighting system and $10,000 for extension to waterworks system will be submitted to the voters.

AULT, COL.—The Town Council has authorized an issue of $12,000 in bonds for the purpose of establishing a municipal electric light plant. It is proposed to purchase the distributing system of the Farmers' Electric & Power Company, which distributes electricity furnished by the Western Light & Power Company in Ault and vicinity.

JULESBURG, COL.—Improvements, it is reported, are contemplated to the municipal electric light plant, to cost about $70,000.

Canada

CALGARY, ALTA.—The City Council has decided to build a new electric railway. The proposed line will cross the city limits at Fiftieth Avenue and will extend across the prairie in almost a direct line to the new hospital site.

EDMONTON, ALTA.—The Department of Public Works is considering the erection of a hospital at Bowness, to cost about $400,000.

GREENWOOD, B. C.—Work will begin at once on the erection of the poles which are to carry the high-tension transmission line of the West Kootenay Light & Power Company from Greenwood to Princeton. The wire, it is expected, will not be strung until next spring.

PORT COQUITLAM, B. C.—The Western Power Company is planning to extend the electric lamps on the Pitt River Road from the present terminus to the shipyards.

WINNIPEG, MAN.—The construction of a three-story factory and a one-story power

house in Winnipeg, to cost about $60,000, is reported to be under consideration by William Kragh. James Chisholm & Son, 80 Great West Permanent Building, are architects.

ST. JOHN, N. B.—Tenders, it is understood, will soon be asked for electric wiring and for signal system, for power house and laundry for the general public hospital.

OJIBWAY, ONT.—Bids are being received by W. P. Perley for workmen's houses and welfare buildings for employees of the Canadian Steel Company. The cost is estimated at about $500,000.

WALKERVILLE, ONT.—The General Motors Company, Ltd., it is reported, contemplates the construction of a plant in Walkerville. The proposed site consists of 38 acres.

EYEBROW, SASK.—The installation of an electric light plant in Eyebrow, to cost about $60,000, is under consideration. Carlyle & Seeley are reported to be interested in the project.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Nov. 13 for copper wire and cables, electrical supplies and fixtures, conduit, laboratory instruments, asbestos gaskets, etc. Blanks and information relating to this circular (1234) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York; New Orleans and San Francisco.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Fort Smith, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St. East, Toronto, Ont.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRIC POWER CLUB, Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Jacksonville, Jan. 5, 1919.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

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INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

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NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass. Annual meeting, Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M. Annual meeting, Albuquerque, N. M., Feb. 17-19, 1919.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

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VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill. Annual meeting, Chicago, January, 1919.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

1,279,508. STORAGE BATTERY; Frederick Wright, Poughkeepsie, N. Y. App. filed Jan. 9, 1914. Electrodes substantially free from shedding and sulphating and particularly adapted for mounting close together.

1,279,591. ARMATURE-CORE SUPPORT; Amato N. Sammarone, Akron, Ohio. App. filed May 21, 1917. Secured together in such a manner that circulation of air is maintained, thereby cooling core.

1,279,593. PROCESS OF PRODUCING PERHALATES; Eugene P. Schoch and Rufus H. Pritchett, Austin, Tex. App. filed April 18, 1918. Anode composed essentially of carbon or silicon is used.

1,279,594. COMBINED CAM AND FINGER ADJUSTMENT DEVICE FOR TIMERS AND DISTRIBUTERS; Albert P. Shaw, Pittsfield, Mass. App. filed July 5, 1917. Readily permits angular adjustment of make-and-break cam used to open and close momentarily the primary circuit of induction coil or magneto electric machine.

1,279,618. ARC LAMP; James H. Wagenhorst, Akron, Ohio. App. filed Dec. 24, 1912. One coil or solenoid eliminated and replaced with spring mechanism which will carry approximately one-half of load imposed by carbon, carbon holder, dash-pot and solenoid.

1,279,631. CIRCUIT BREAKER; Louis Abeno, Meriden, Conn. App. filed March 29, 1917. Maintains parallelism of contacts, notwithstanding their adjustment for varying their separation as may be required for whatever purpose.

1,279,643. FIELD-POLE CONSTRUCTION; Arthur J. Brown, Milwaukee, Wis. App. filed Aug. 7, 1915. Means for securing winding in place on pole, involving utilization of flux-carrying parts of pole.

1,279,652. ELECTRIC CONTROLLING SYSTEM; Allen D. Cardwell, Brooklyn, N. Y. App. filed Sept. 5, 1914. Impulses cause isochronous operation of contact-closing means at transmitting and receiving stations.

1,279,653. MAGNET CONTROL; Allen D. Cardwell, New York, N. Y. App. filed Nov. 16, 1914. Various operations of electromagnet may be controlled with respect to time at which or during which these operations are performed.

1,279,666. DYNAMO-ELECTRIC MACHINE; Rae W. Davis and Robert B. Williamson, Milwaukee, Wis. App. filed April 18, 1914. Means for protecting parts of dynamo-electric machines from dust and foreign matter and for maintaining such devices at comparatively low operating temperature.

1,279,681. INTERLOCKING RELAY; Oscar S. Field, Elizabeth, N. J. App. filed June 27, 1916. Means of interlocking two sides of relay in simplified manner.

1,279,738. OVEN FOR BURNING OUT INVESTED MODELS; Theodore W. Maves, Minneapolis, Minn. App. filed April 24, 1918. Means for melting wax model of dental casting.

1,279,748. SYSTEM OF CONTROL; Ray C. Newhouse, Wawatosa, Wis. App. filed May 9, 1912. Skip hoist, for hoisting stone, coal, ore, etc., is normally completely automatic in operation but may be manually controlled when desired.

1,279,750. MAGNETO-ELECTRIC GENERATOR; Richard A. Oglesby, South Bend, Ind. App. filed Feb. 17, 1916. Simple and compact ignition device for single or multi-cylinder internal-combustion engines.

1,279,763. COMBINED CONTROL AND BRAKE FOR SEWING MACHINES; Paul P. Ruhe, Hoboken, N. J. App. filed July 12, 1916. Electric motor and rheostat for regulating current are employed, and vertical treadle-operated shaft is arranged to control operation.

1,279,769. ENERGY-TRANSLATING DEVICE; Reginald F. Smith, West Allis, Wis. App. filed May 22, 1915. To furnish energy with one or more substantially constant characteristics.

1,279,799. SWITCH; Halfdan A. Steen, Milwaukee, Wis. App. filed June 19, 1911. Improved operating mechanism and contact arrangement.

1,279,780. CIRCUIT CONTROLLER; Halfdan A. Steen, Milwaukee, Wis. App. filed July 25, 1914. Active fixed and movable circuit-breaking parts can be readily removed from inclosing receptacle for inspection and repairs.

1,279,781. CIRCUIT-INTERRUPTING APPARATUS; Halfdan A. Steen, Milwaukee, Wis. App. filed July 25, 1914. Shifting magnetic field is made use of in extinguishing are formed between fixed and movable contacts.

Record of Electrical Patents

Notes on United States Patents

1,279,789. INCANDESCENT LAMP; Frederick G. Talley, St. Louis, Mo. App. filed Jan. 31, 1917. Sudden vibration or movement of any of filament coils prevented, thus reducing danger of breakage of filament.

1,279,790. MOTOR CONTROLLER; Emanuel Tobiessen, West Allis, Wis. App. filed July 24, 1915. For induction motors; comprises coöperative primary and secondary control elements that accomplish desired control and at same time fully protect motor.

1,279,803. LIGHT SUPPORT; George F. Watson, Rockland, Me. App. filed Sept. 29, 1917. Tension of spring coacting with movable members may be regulated upon relative movement of certain members comprised in stand.

1,279,807. SWING JOINT FOR LIGHTING FIXTURES; Ernest C. White, Westmount, Quebec, Canada. App. filed June 3, 1915. Invertible fixture in which source of light is movable with reflector and is maintained automatically in two extreme positions without aid of positive retaining devices.

1,279,808. HOWLER CIRCUITS FOR TELEPHONE LINES; Ray S. Wilbur, Jersey City, N. J. App. filed March 18, 1915. For connecting with any telephone line in which receiver has been inadvertently left from hook.

1,279,810. RETAINING WEDGE FOR DYNAMO-ELECTRIC MACHINES; Robert B. Williamson, Milwaukee, Wis. App. filed Dec. 1, 1916. Of laminated magnetic material for securing windings in slots of machines.

1,279,811. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Dec. 8, 1916. If all connecting circuits of particular line group are busy, the initiation of a call in such group will automatically remove artificial busy condition of other positions.

1,279,812. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed July 14, 1917. Relates to call-distributing system in which calling lines are extended to call-receiving units by means of automatic switching apparatus.

1,279,815. ELECTRIC SWITCH; Louis W. Wipperman, Buffalo, N. Y. App. filed Aug. 30, 1916. For use in connection with device for automatically turning on electric lights when unauthorized intruder enters building.

1,279,816. IGNITION APPARATUS; Lionel Wolffsohn, Hoboken, N. J. App. filed April 30, 1915. Adapted to automatically meet changing conditions of running for reducing undesirable sparking.

1,279,820. ILLUMINATED NOTE PAD; Werner A. a Brassard, New York, N. Y. App. filed Aug. 27, 1917. For use in making night-time military observation.

1,279,823. PROCESS AND APPARATUS FOR CAUSING PRECIPITATION BY COALESCENCE OF AQUEOUS PARTICLES CONTAINED IN THE ATMOSPHERE; John G. Balsillie, Melbourne, Victoria, Australia. App. filed June 22, 1916. Consists of electrical means for promoting formation of aqueous particles in the atmosphere and assisting the deposition of these particles.

1,279,840. SWITCHBOARD APPARATUS AND CIRCUITS; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 4, 1916. System for establishing telephone connection between subscribers.

1,279,841. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. Relates to systems in which automatic switches are used in establishing connections, either wholly or in part.

1,279,842. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 29, 1917. To provide panel-type contact bank into which "slipped" multiple connections are built.

1,279,850. WIRELESS APPARATUS AND METHOD THEREFOR; William Dubilier, New York, N. Y. App. filed May 6, 1913. Relates to sending apparatus which will produce efficiently electrical oscillations suitable for use in wireless telegraphy, and method of producing such oscillations.

1,279,854. AUTOMATIC ELECTROMAGNETIC SWITCH; Oscar E. Forsberg, Yonkers, N. Y. App. filed Dec. 8, 1916. Automatically returns to normal position when its restoring circuit is closed.

1,279,860. ELECTROLYTIC PROCESS; William E. Greenawalt, Denver, Col. App. filed Feb. 24, 1914. For maintaining variable valent elements in impure electrolyte at their lowest valency and thus to a large extent increasing cathode efficiency.

1,279,867. ELECTRICALLY PROPELLED VEHICLE; Edmund H. Hewins, Sharon, Mass. App. filed Feb. 8, 1917. Controlling means whereby during certain operations of vehicle some power may be stored and subsequently used when additional power is required.

1,279,875. TELEPHONE-EXCHANGE SYSTEM; Charles W. Keckler, Newark, N. J. App. filed Nov. 17, 1917. Relates to systems of central energy type employing connecting or link circuits provided with apparatus for automatically applying ringing current to called-for line upon connection being made therewith.

1,279,882. SIGNALING SYSTEM; George W. Kuhn, Brooklyn, N. Y. App. filed March 29, 1915. Produces tone in receiver warning subscriber that it has been left off hook after proper length of time has elapsed.

1,279,887. METHOD OF OPERATING DYNAMO-ELECTRIC MACHINES; Hans Lippelt, Brooklyn, N. Y. App. filed Oct. 13, 1909. For effecting sparkless commutation of current in windings.

1,279,893. SELECTOR SWITCH; James K. McQuarrie, Montclair, N. J. App. filed Sept. 5, 1916. Relates to type used in automatic and semi-automatic telephone systems.

1,279,894. TELEPHONE RECEIVER; George E. Mather, East Orange, N. J. App. filed July 9, 1917. Relates to rapid adjustment of vibratory diaphragms.

1,279,905. SYNCHRONIZING SYSTEM FOR MULTIPLEX TELEGRAPHS; Paul M. Rainey, West Hoboken, N. J. App. filed March 26, 1914. Relates particularly to system wherein at one station a distributer is rotated at practically constant speed and at any other station a similar distributer is kept in step with first, and variations either of acceleration or retardation are automatically corrected.

1,279,928. THREE-PHASE ELECTRIC FURNACE AND METHOD OF OPERATING SAME; Frederick T. Snyder, Oak Park, Ill. App. filed March 11, 1918. Three-phase current may be supplied directly to electric furnace having two carbon electrodes and a bottom contact without special transformers.

1,279,940. WEATHERPROOF SOCKET; George B. Thomas, Bridgeport, Conn. App. filed March 28, 1918. Of two-piece base construction which insures complete inclosure of wiring connections.

1,279,941. CONDENSER AND PROCESS OF MAKING THE SAME; Phillips Thomas, Edgewood Park, Pa. App. filed Nov. 7, 1916. Folding the edges of dielectric layers to compensate for thickness of metal foil, thus giving edges of completed condenser same thickness as central portions.

1,279,953. STORAGE BATTERY; Theodore A. Willard, Cleveland, Ohio. App. filed July 6, 1915. Means for sealing terminal posts in battery-jar cover to prevent creepage of acid or battery solution around posts to exterior of cover.

1,279,958. SWITCH FOR ELECTRIC STARTERS; Thomas Zimmerman, Niagara Falls, N. Y. App. filed Dec. 13, 1915. Manual starting switch which when moved to closed position will automatically retard spark and when pressure is removed will automatically move to open position and at same time adjust spark.

1,279,968. INCLOSED FUSE; Harold G. Baxter, Wilkinsburg, Pa. App. filed Nov. 25, 1914. For renewable use and embodying means for visibly disclosing condition.

1,279,990. METHOD OF CONTROLLING AND APPARATUS FOR PRODUCING IONIC DISCHARGES; Daniel F. Comstock, Brookline, Mass. App. filed Nov. 14, 1916. Arc carrying a heavy current used to produce on one of a pair of electrodes a steady incandescent area out of alignment with other electrode.